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Project KI23510.A0

INTERIM REPORT

DEVELOPMENT AND DEMONSTRATION OF NEW PROCESS STANDARDS FOR UPGRADED BIOGAS ENERGY UTILIZATION OF MUNICIPAL ANAEROBIC DIGESTION FACILITIES IN CANADA

Prepared for:

Renewable Energy Branch
Energy, Mines and Resources Canada
Ottawa, Ontario, Canada
DSS Contract File No. 6ZSS.23216-6-6166
February 1988

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ACKNOWLEDGMENTS

The authors would like to express their sincere thanks to the municipal contact personnel who were extremely cooperative in filling out the questionnaires. The authors would also like to thank Messrs. E.N. Hogan and R.D. Hayes of Energy, Mines and Resources Canada and D. Hay of Environment Canada for their assistance in the completion of this phase of the project.

CORRECT CITATION

Barclay, J.A. and A.R. Stickney, CANVIRO Consultants. "Interim Report on the Development and Demonstration of New Process Standards for Upgraded Biogas Energy Utilization of Municipal Anaerobic Digestion Facilities in Canada". Interim Report for Contract File #62SS.23216-6-6166. Renewable Energy Division; Energy, Mines and Resources Canada, Ottawa, Ontario, Canada, 1988. (88 pp).

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PREFACE

This report presents an assessment of the current practices and technologies used in the generation and utilization of biogas produced in Canadian municipal wastewater treatment plants.

The information contained in this report was obtained from questionnaires designed to collect specific system operating data. A questionnaire was distributed to all Canadian municipal wastewater treatment plants employing anaerobic digestion.

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The information collected was analyzed and the current practices employed at the treatment plants were identified. This report summarizes these practices.

ABSTRACT

The overall objective of this project was to develop new process standards and strategies for optimum production and utilization of biogas at municipal anaerobic digestion facilities in Canada. This was accomplished through the collection of critical cost-benefit information required to define optimum biogas utilization scenarios which takes into account such factors as plant size, digester performance and design, climatic conditions and existing hardware.

As the first step towards this goal, the current practices and technologies in use at Canadian municipal wastewater treatment plants were assessed.

Questionnaires designed to collect the information required to perform the assessment were distributed and response to the questionnaires was high (70%). Excellent database information was collected which will be used to develop the biogas utilization strategies for municipal wastewater treatment plants.

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EXECUTIVE SUMMARY

To date, a comprehensive investigation of the alternative strategies available, or to be developed, for the effective recovery and utilization of biogas produced at municipal anaerobic digestion systems in Canada has not been performed. Furthermore, little information is available identifying or verifying the actual quantities of biogas produced. The objective of this project was to develop these strategies by first assessing the current practices and technologies in use in Canada and then comparing the technical aspects and economics of retrofitting existing systems or providing new systems with technologies to upgrade biogas utilization efficiency.

An extensive literature review was conducted in order to determine the number of municipal anaerobic digestion systems currently operating in Canada. A questionnaire, designed to collect specific system operating data, was forwarded to contact personnel at each plant. Response to the questionnaires was high (70%).

The database information will be used to develop the optimum biogas utilization strategies for municipal wastewater treatment.

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1.0 INTRODUCTION AND BACKGROUND

1.1 Background

Over eleven million people in Canada were served by municipal wastewater treatment plants in 1981 (Environmental Protection Service, 1981). It is projected that an additional six million Canadians will receive this service by the end of the 1980's. There are presently over 1382 municipal wastewater treatment plants in Canada, treating 60% of the domestic wastewater generated. Of the 1382 municipal treatment plants, 74 provide primary treatment and 507 provide secondary treatment. The remainder provide treatment using lagoons, communal septic tanks and other treatment processes.

Primary treatment consists of gravity separation and removal of suspended solids and biochemical oxygen demanding (BOD) contaminants from the wastewater. Suspended solids removals of 65-85% and BOD removals of 35-65% are achievable with primary treatment. The higher removal levels occur in plants with chemical addition (e.g. ferric chloride) for phosphorus removal. Primary plants produce a significant quantity of sludge requiring stabilization and disposal to complete the treatment process.

Secondary treatment systems are generally the activated sludge type following primary treatment. The activated sludge system consists of an aerated suspension of microorganisms in contact with the wastewater. These microorganisms remove those dissolved components not removable by gravity separation. In municipal activated sludge systems, approximately 90-95% of the suspended solids and BOD can be removed. This results in an increased amount of sludge to be treated and disposed of beyond the amount produced in primary plants.

Anaerobic digestion is used at many treatment plants in Canada to treat primary and waste activated sludges. Anaerobic digestion is a biological fermentation process in which organic matter is decomposed in the absence of air or oxygen. Anaerobic bacteria convert complex materials such as carbohydrates and lipids to simpler compounds which are then reduced to biogas. This biogas is dirty and wet containing methane (65%), carbon dioxide (35%), hydrogen sulfide and other minor constituents. Biogas has an energy equivalent of about 24,210 kJ/m^3 (natural gas = 37,210 kJ/m^3), (Grady, 1980). The general technology of anaerobic digestion is well-known and has been applied for many years to treat the waste sludge generated in the municipal wastewater treatment plants. The process of anaerobic digestion is widely used in Canada for the purpose of sludge volume reduction and stabilization.

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Table 1 summarizes the typical quantities of undigested sludge to be treated from primary and primary plus secondary wastewater treatment systems (Ontario Ministry of Environment, 1984).

Table 1
TYPICAL UNDIGESTED SLUDGE GENERATION RATES FOR PRIMARY AND PRIMARY PLUS SECONDARY WASTEWATER TREATMENT SYSTEMS

Wastewater Treatment Systems	Without Phosphorus Removal			With Phosphorus Removal		
	Dry (g/m^3)	Volatile (%)	Volume (L/m^3)	Dry (g/m^3)	Volatile (%)	Volume (L/m^3)
Primary	120	65	2.0	170	65	3.2
Primary + Secondary	180	65	4.0	220	60	5.0

(Ontario Ministry of Environment, 1984).

Recently, the generation and utilization of the biogas from anaerobic digestion systems has received increased attention largely because of its energy-producing potential. Possible applications for biogas energy utilization include boiler fuel, stationary engine fuel, vehicle fuel, and electrical power co-generation.

In general, comprehensive methods to determine strategies for the optimum generation and utilization of municipal digester biogas are not available. The two major limitations to effective usage of biogas in Canada are thought to be:

- lack of a database and decision-making process to determine the feasibility of utilizing the biogas;
- lack of appropriate strategies which have been developed to utilize the biogas generated.

While biogas is already used at municipal plants to reduce treatment process costs, it is anticipated that additional energy and cost savings could be achieved at many of these plants by the appropriate use of this constantly renewable resource.

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1.2 Objectives

The objective of this project is to develop and demonstrate new process standards and strategies for optimum production and utilization of biogas at municipal anaerobic digestion facilities in Canada. The specific objectives are as follows:

1. establish optimum biogas handling and utilization processes for medium and large digester facilities in various regions of Canada by:

   a) assessing the current practices and technologies in use in Canada and other countries, and,

   b) comparing the technical aspects and economics of retrofitting existing systems or providing new systems with new technologies to upgrade biogas utilization efficiency by such methods as:

      - electrical co-generation;
      - commercial sale;
      - driving treatment plant pumps; and blowers
      - improve digester and space heating.

2. screen and select an example municipal anaerobic digester at which to demonstrate selected new and/or improved biogas utilization technologies (Phase II).

It is the assessment of the current practices and technologies used in the generation and utilization of biogas produced in Canadian municipal wastewater treatment plants which will be addressed in this interim report.

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2.0 REVIEW OF THE STATE-OF-THE-ART BIOGAS GENERATION, RECOVERY AND UTILIZATION PRACTICES

2.1 Review of Literature

There are many factors which greatly affect biogas production from anaerobic digestion systems. Two of the most critical factors are heating and mixing. As the bacteria cultured in the digestion process are commonly mesophilic (survive at temperatures ranging from 30 to 38 C), it is imperative that the temperature be maintained in this range. The bacteria do not tolerate severe fluctuations in temperature, therefore, it is important to maintain a constant temperature within the digester.

Adequate mixing is also crucial for optimum digester performance. Monteith and Stephenson (1981) state that "Adequate mixing is essential to transfer substrate and heat to the microorganisms, to maintain uniformity in other factors, and to prevent solids deposition and scum formation in primary digesters.... Inadequate mixing will lead to incomplete stabilization of raw sludge. Energy recovery by methane gas production and pathogenic organism reduction will be less efficient." The authors used a sodium fluoride tracer to determine digester mixing efficiencies at two water pollution control plants in Ontario. Their results indicate that there was severe short circuiting in both sets of digesters and that as much as 77% of the active volumes were not being adequately mixed.

The demonstration of a more effective digester biogas generation and utilization strategy has been carried out at the Orangeville, Ontario, water pollution control plant. This site-specific study showed that significant cost savings could be achieved through electrical co-generation and exhaust heat recovery with cost savings of $70,000 per annum (Anon, 1985).

At the Peterborough, Ontario, water pollution control plant biogas is used to fuel the plant's boilers as well as a 200 kW co-generation system. The electrical requirements of the plant are greatly reduced and enough heat energy is produced to heat the plant and digestion tanks (Atlas Polar, 1987).

In the United States, more effort has been directed to recovery and utilization of biogas to replace other fuels or electricity. The Metropolitan St. Louis Sewer District evaluated the practical and economic feasibility of using methane fueled internal combustion engines versus electrical motors at a 25 U.S. MGD activated sludge plant (Karney, 1981). The study showed that biogas fueled engines produced a 21.6% savings on an annual worth basis over electrical

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motors used to drive process equipment such as pumps and blowers. Seventy-two percent of the plant's total energy requirement is met through biogas utilization and recovery of engine waste heat.

Electrical co-generation from biogas has been practiced at the Los Angeles Hyperion water pollution control plant. The average production rate is 140,000 kWh/day with one-third of the amount available for sale to a local electrical utility (Owen, 1982).

In Modesto, California, it has been reported (Owen, 1982) that a dual-fuel system for vehicles has been tested using cleaned, scrubbed biogas consisting of 98% methane.

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3.0 PRESENT TRENDS IN MUNICIPAL ANAEROBIC DIGESTION IN CANADA

3.1 Municipal Anaerobic Digestion System Enumeration

All available documentation pertaining to Canadian wastewater treatment plants, including the "National Inventory of Municipal Waterworks and Wastewater Systems in Canada", (Minister of Supply and Services Canada, 1981) and the "MUNDAT Inventory, Wastewater Facilities", (Environmental Protection Service, 1986), were reviewed in order to determine the number of municipal anaerobic digestion systems currently operating in Canada.

A contact person was established at all plants employing anaerobic digestion. A letter explaining the nature of the project, along with a questionnaire, was forwarded to each contact person. The questionnaire was designed to collect specific system operating data such as:

- overall wastewater treatment plant characteristics;
- specific information for anaerobic digestion including digester types, numbers, volumes, organic loading, operating temperatures, heating systems, natural gas requirements, gas storage capabilities, gas metering capabilities, gas generation rates and qualities, gas use/flaring, etc.

The questionnaire, which was produced in both official languages, is presented in Appendix A.

One hundred and thirty two questionnaires were sent out and 92 replies were received. Of the questionnaires returned 21 indicated that their plants were either not operating or no longer employed anaerobic digestion (Table B-1). Table 2 summarizes the number of systems which indicated that they currently employ anaerobic digestion. Each system has been placed in an arbitrarily selected size category based on the design hydraulic capacity of the wastewater treatment plants. A complete list of these facilities is presented in Table B-2.

Follow up telephone calls were made to many of the plants to verify the data generated by the questionnaires and to uncover other potentially useful information in connection with digester operation.

The information collected from the questionnaires was catalogued using the micro-computer database system dBase III Plus. Print-outs of the catalogued information are presented in Appendix B. Section 3.2 summarizes this information.

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Table 2
CANADIAN MUNICIPAL ANAEROBIC DIGESTION SYSTEMS

Size Category	Treatment Plant Design Capacity (m^3/d)	Number of Systems with Digesters
Small	0 - 25,000	34
Medium	25,000 - 100,000	24
Large	>100,000	13
TOTAL	-	71

3.2 Questionnaire Response

Table 3 summarizes the average daily biogas production for each of the treatment plant size categories defined in Table 2. Included in the table are the theoretical biogas production estimates for each size category. These were calculated from the volatile solids loading rate reported for each system assuming that approximately 0.6 m^3 of biogas is produced per kilogram of volatile solids added to the digester (WPCF, 1977).

Table 3
MEAN DAILY BIOGAS PRODUCTION

Size Category	Daily Biogas Production (m^3/d)			Average Theoretical Biogas Production (m^3/d)
	Mean	S.D.	n	
Small	457	319	18	772
Medium	2,913	1,958	22	2,965
Large	14,202	11,490	12	21,278

The mean actual daily biogas production rate was considerably lower than the theoretical production rate for the small and large sized plant categories and marginally lower for the medium sized plant category.

The biogas data was divided into two categories according to the type of process used in each plant. Data for primary treatment plants was placed in category 1 and data for

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secondary treatment plants was placed in category 2. Stepwise regression analysis was performed on the data to determine the relationships between biogas production and each of the following factors: design plant flow, average plant flow, population served, and design BOD plant loading. Based on the results of the analysis, the following equations were selected to describe the data:

$$\text{Biogas} = 379 + (0.047 * \text{Design Flow}) - (0.014 * \text{Design Flow} * \text{Process}) \quad m^3/d$$

where R*R = 0.80 (1)

$$\text{Biogas} = -135 + (0.077 * \text{Average Flow}) - (0.032 * \text{Average Flow} * \text{Process}) \quad m^3/d$$

where R*R = 0.87 (2)

$$\text{Biogas} = -55 + (0.048 * \text{Population}) \quad m^3/d$$

where R*R = 0.90 (3)

$$\text{Biogas} = 2215 + (0.125 * \text{BOD Loading}) \quad m^3/d$$

where R*R = 0.56 (4)

where: Process = 1 for primary plants and Process = 0 for secondary plants.

Figures 1A through 1C illustrate the relationship between design plant flow and biogas production. As expected, biogas production increased with increasing design plant flow. The linear model (Equation 1) presents a relatively good representation of this relationship (R*R = 0.80). The interactive effect of process and design flow was significant ($P < 0.05$). The curves indicate that a greater biogas production rate can be expected in secondary treatment plants than in primary treatment plants treating the same design flow.

Figures 2A through 2C illustrate the relationship between average plant flow and biogas production. As with the design flow, there was a strong linear relationship (R*R = 0.87) between increasing average flow and increasing biogas production. The interactive effect of process and average flow was significant and greater biogas production can be expected in secondary treatment plants for any given average plant flow. A higher correlation was obtained from the actual wastewater flow data than from the design flow as would be expected since many plants are not operating at design flows.

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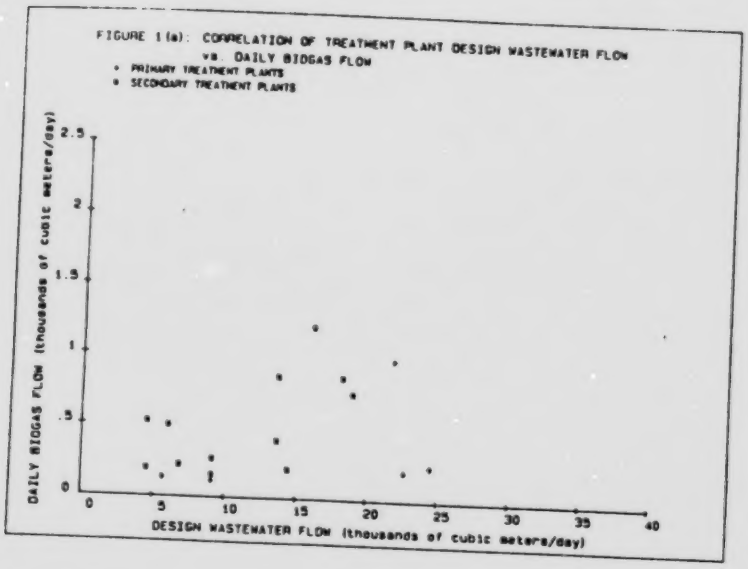
FIGURE 1(a): CORRELATION OF TREATMENT PLANT DESIGN WASTEWATER FLOW
vs. DAILY BIOGAS FLOW
• PRIMARY TREATMENT PLANTS
• SECONDARY TREATMENT PLANTS
DAILY BIOGAS FLOW (thousands of cubic meters/day)
2.5
2
1.5
1
.5
0
0
5
10
15
20
25
30
35
40
DESIGN WASTEWATER FLOW (thousands of cubic meters/day)

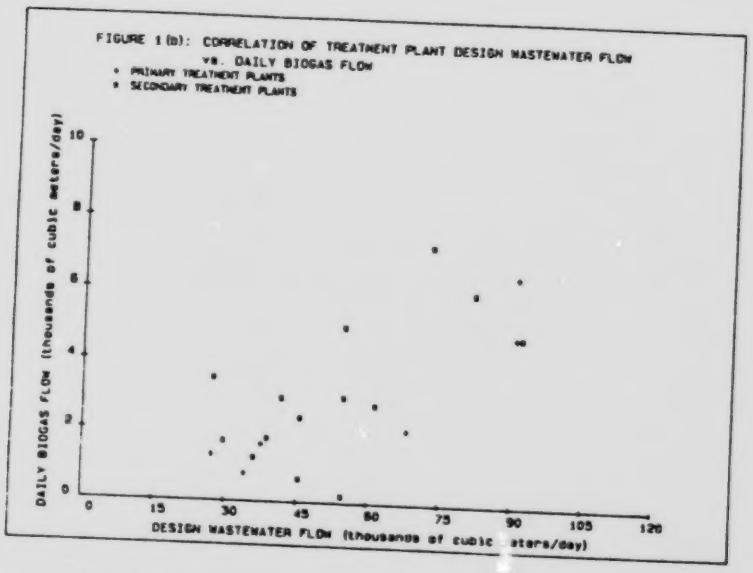
FIGURE 1(b): CORRELATION OF TREATMENT PLANT DESIGN WASTEWATER FLOW
vs. DAILY BIOGAS FLOW
• PRIMARY TREATMENT PLANTS
• SECONDARY TREATMENT PLANTS
DAILY BIOGAS FLOW (thousands of cubic meters/day)
10
8
6
4
2
0
0
15
30
45
60
75
90
105
120
DESIGN WASTEWATER FLOW (thousands of cubic meters/day)

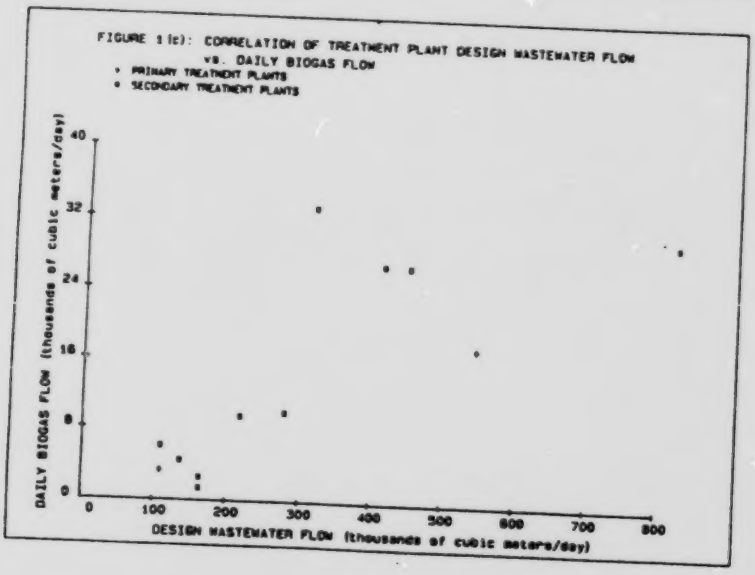
FIGURE 1(c): CORRELATION OF TREATMENT PLANT DESIGN WASTEWATER FLOW
vs. DAILY BIOGAS FLOW
• PRIMARY TREATMENT PLANTS
• SECONDARY TREATMENT PLANTS
DAILY BIOGAS FLOW (thousands of cubic meters/day)
40
32
24
16
8
0
0
100
200
300
400
500
600
700
800
DESIGN WASTEWATER FLOW (thousands of cubic meters/day)

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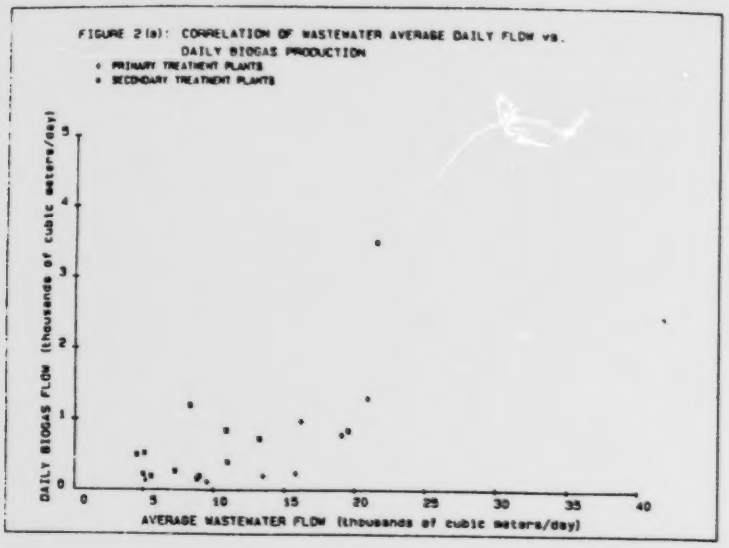
FIGURE 2(a): CORRELATION OF WASTEWATER AVERAGE DAILY FLOW vs.
DAILY BIOGAS PRODUCTION
+ PRIMARY TREATMENT PLANTS
o SECONDARY TREATMENT PLANTS
DAILY BIOGAS FLOW (thousands of cubic meters/day)
AVERAGE WASTEWATER FLOW (thousands of cubic meters/day)

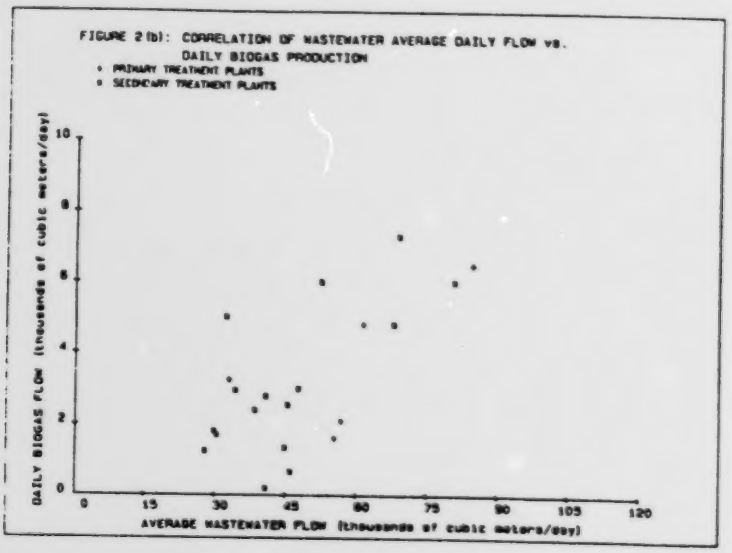
FIGURE 2(b): CORRELATION OF WASTEWATER AVERAGE DAILY FLOW vs.
DAILY BIOGAS PRODUCTION
+ PRIMARY TREATMENT PLANTS
o SECONDARY TREATMENT PLANTS
DAILY BIOGAS FLOW (thousands of cubic meters/day)
AVERAGE WASTEWATER FLOW (thousands of cubic meters/day)

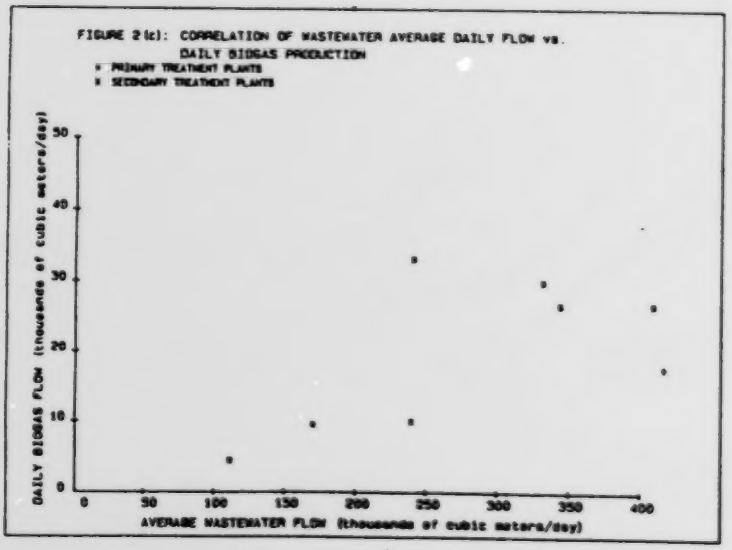
FIGURE 2(c): CORRELATION OF WASTEWATER AVERAGE DAILY FLOW vs.
DAILY BIOGAS PRODUCTION
+ PRIMARY TREATMENT PLANTS
x SECONDARY TREATMENT PLANTS
DAILY BIOGAS FLOW (thousands of cubic meters/day)
AVERAGE WASTEWATER FLOW (thousands of cubic meters/day)

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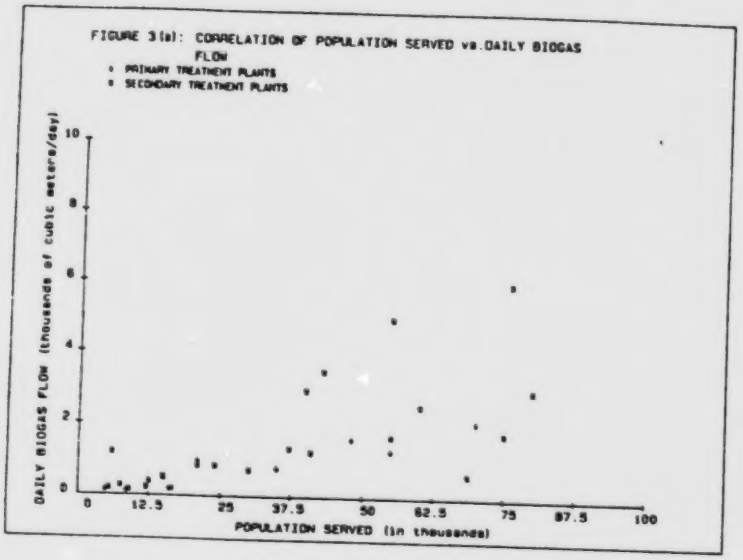
FIGURE 3(a): CORRELATION OF POPULATION SERVED vs.DAILY BIOGAS FLOW
* PRIMARY TREATMENT PLANTS
* SECONDARY TREATMENT PLANTS
DAILY BIOGAS FLOW (thousands of cubic meters/day)
0
2
4
6
8
10
0
12.5
25
37.5
50
62.5
75
87.5
100
POPULATION SERVED (in thousands)

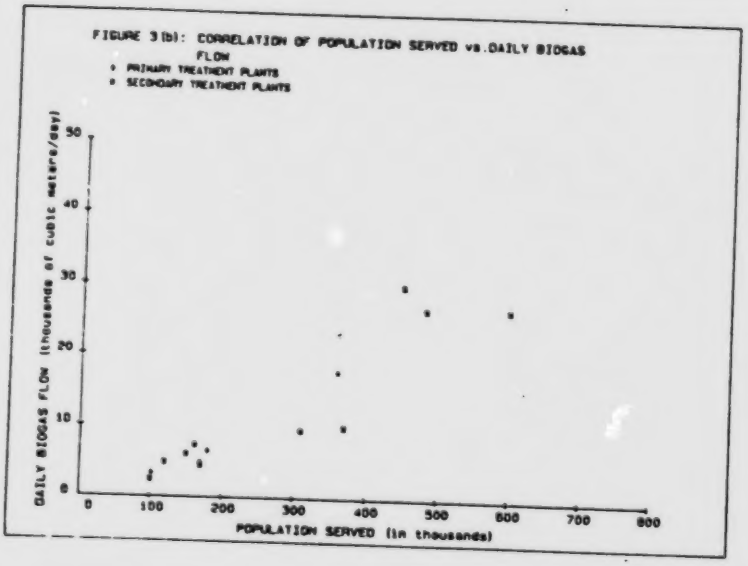
FIGURE 3(b): CORRELATION OF POPULATION SERVED vs.DAILY BIOGAS FLOW
* PRIMARY TREATMENT PLANTS
* SECONDARY TREATMENT PLANTS
DAILY BIOGAS FLOW (thousands of cubic meters/day)
0
10
20
30
40
50
0
100
200
300
400
500
600
700
800
POPULATION SERVED (in thousands)

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The relationship between population served and biogas produced is presented in Figures 3A through 3C. Biogas production increased with increasing population. Once again, the linear model (Equation 3) provides a good representation of the relationship (R*R = 0.90). The interactive effect of process and population was insignificant.

Equation 4 describes the relationship between BOD loading and biogas production as illustrated in Figures 4A through 4C. Biogas production increased with increasing design BOD loading however the linear correlation between them was not as strong as it was with the other factors (R*R = 0.56). The interactive effect of process and BOD was insignificant.

In each of the above relationships, the effect of process, as a main variable, was insignificant indicating that the process alone had no effect on biogas production.

There are many basic practices which greatly effect biogas production. Maintaining a constant digester temperature of 30 to 38 C (mesophilic range) is generally considered optimum for municipal systems. Proper insulation of the digestion tanks is also important as it reduces heat loss and stabilizes temperature. Efficient mixing of the digester contents increases total bacterial activity and thus biogas production, by ensuring that the bacteria come into contact with the undigested material. Table 4 summarizes the number of Canadian municipal anaerobic digestion systems surveyed which employ these practices.

Table 4
CURRENT PRACTICES IN DIGESTION

Practice	Digester	Number of Plants Employing Practice	Total Number of Systems	Percentage
Heating	Primary	71	71	100
	Secondary	7	56	13
Insulating	Primary	42	71	59
	Secondary	30	56	54
Mixing	Primary	68	71	96
	Secondary	-	56	-

All plants surveyed, stated that they maintained a constant primary digester temperature in the mesophilic range (30 to 38 C). Only 10% maintained this temperature range in their secondary digesters. The majority of the systems used a hot

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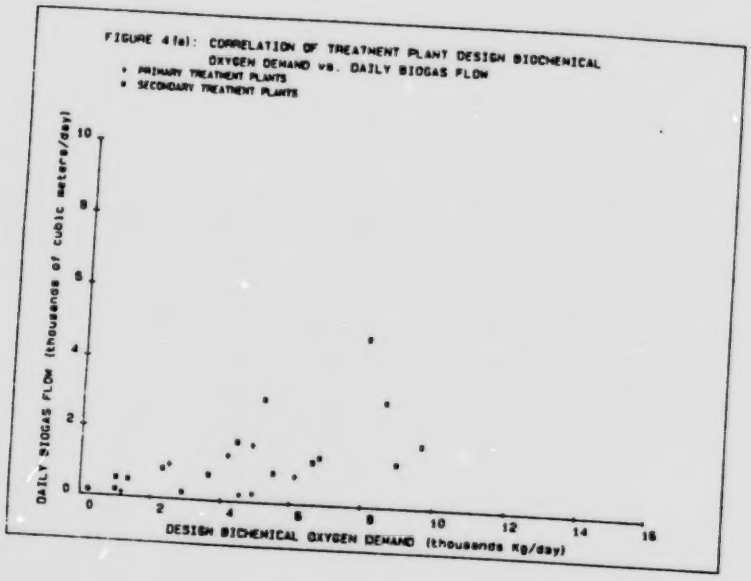
FIGURE 4 (a): CORRELATION OF TREATMENT PLANT DESIGN BIOCHEMICAL OXYGEN DEMAND vs. DAILY BIOGAS FLOW
• PRIMARY TREATMENT PLANTS
▪ SECONDARY TREATMENT PLANTS
DAILY BIOGAS FLOW (thousands of cubic meters/day)
0
2
4
6
8
10
DESIGN BIOCHEMICAL OXYGEN DEMAND (thousands Kg/day)
0
2
4
6
8
10
12
14
16

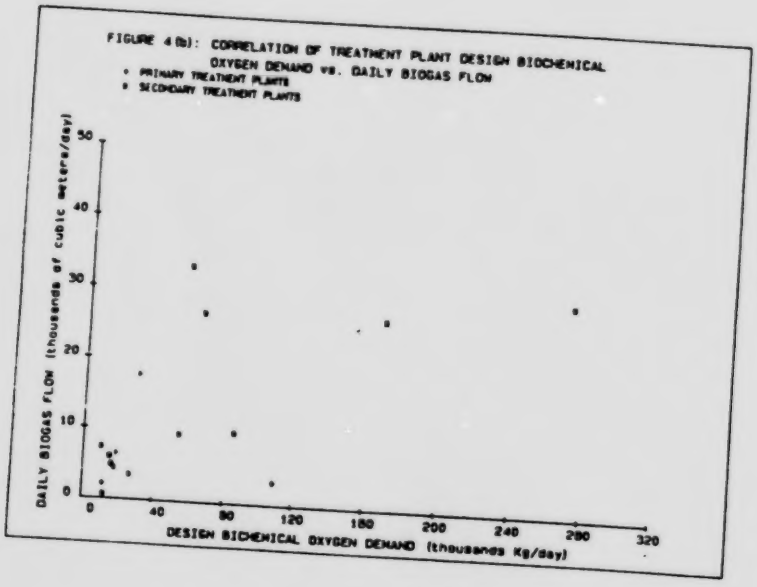
FIGURE 4 (b): CORRELATION OF TREATMENT PLANT DESIGN BIOCHEMICAL OXYGEN DEMAND vs. DAILY BIOGAS FLOW
• PRIMARY TREATMENT PLANTS
▪ SECONDARY TREATMENT PLANTS
DAILY BIOGAS FLOW (thousands of cubic meters/day)
0
10
20
30
40
50
DESIGN BIOCHEMICAL OXYGEN DEMAND (thousands Kg/day)
0
40
80
120
160
200
240
280
320

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water - sludge recirculation heat exchanger to heat their digesters and the remainder used other miscellaneous heat exchangers (Table 5).

Table 5
DIGESTER HEATING SYSTEMS

Heating System	No. Plants	% of Total
Hot Water - Sludge Recirc. Heat Exchanger	59	83
Hot Water - Pipe Coil Heat Exchanger	8	11
Other	4	6
TOTAL	71	100

The most commonly used insulating material was styrofoam followed by a variety of other conventional insulating materials. However, many systems did not insulate at all or were built partially underground using earth as insulation.

Digester mixing was most commonly accomplished using biogas recirculation although some systems employed mechanical mixing (Table 6).

Table 6
DIGESTER MIXING SYSTEMS

Mixing System	No. Plants	% of Total
Mechanical	11	16
Gas Mixing	39	55
Sludge Recirc.	6	8
Gas & Sludge Recirc.	9	13
Gas & Mechanical	2	3
No Mixing	3	4
Unknown	1	1
TOTAL	71	100

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Table 7 summarizes the various uses sited for the biogas produced at the plants surveyed. Seventy five percent of the plants stated that they burned their biogas in boilers and most used the energy to heat their digestion tanks and/or control buildings. Ten percent of the plants used their biogas to fuel engine generator sets to produce heat and electricity. Uses for the electricity included load shaving and running process equipment. One plant used its biogas in an incinerator and the remainder flared their biogas.

Table 7
BIOGAS UTILIZATION PRACTICES

Practice	No. Plants	% of Total
Boiler	53	75
Boiler + Engine/Generator	7	10
Other	1	1
None	10	14
TOTAL	71	100

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4.0 SUMMARY AND CONCLUSIONS

The biogas generated by the anaerobic digestion facilities in municipal water pollution control plants across Canada represents a major potential source of bio-energy. In most cases, the biogas is used solely to heat the digestion tanks and excess gas is often flared to the atmosphere. No comprehensive attempt has been made to optimize biogas generation rates or biogas utilization. Further, the information required to determine the most cost-effective approach to biogas utilization in municipal treatment facilities is not readily available. It has been estimated that the potential value of gas produced by municipal digestion systems may be as much as $12,700,000 annually. Optimized utilization of this biogas could significantly reduce the operating costs associated with municipal wastewater treatment.

A questionnaire designed to collect information on the current practices employed at municipal anaerobic digestion facilities in Canada was forwarded to contact personnel at each plant. Response to the questionnaires was high (70%).

The actual biogas production rates reported were compared to those calculated using the volatile solids loading rates reported at each plant. The actual biogas production rates were considerably lower than expected at small (<25,000 m^3/d design flow) and large (>100,000 m^3/d) sized plants and marginally lower than expected at medium sized (25,000 - 100,000 m^3/d) plants.

All plants surveyed indicated that they maintained a constant mesophilic (30 to 38 C) temperature in their primary digesters. Fifty nine percent of the plants insulated their primary digesters and 96 percent employed some form of digester mixing. Thirteen percent of the plants surveyed indicated that they heated their secondary digesters and 54 percent insulated them.

Seventy five percent of the plants stated that they used the biogas they produced to fuel boilers and produce heat for their digestion tanks and/or control buildings. Ten percent used their biogas to fuel engine generator sets to produce electricity and heat. The remainder flared the biogas produced at their plants.

Excellent database information was collected which will be used to develop biogas utilization strategies for municipal wastewater treatment plants.

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5.0 REFERENCES

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APPENDIX A

MUNICIPAL ANAEROBIC DIGESTER
BIOGAS UTILIZATION QUESTIONNAIRE

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APPENDIX A - MUNICIPAL ANAEROBIC DIGESTER BIOGAS UTILIZATION QUESTIONNAIRE

PROJECT 85-510

1) GENERAL INFORMATION

NAME OF FACILITY: _____

MUNICIPALITY: _____

M.O.E. PLANT IDENTIFICATION NO: _____

ADDRESS: _____

_____

_____

TELEPHONE NO: _____

CONTACT PERSON: _____

POSITION: _____

Would you be interested in obtaining a copy of the final report?

YES ____ NO ____

2) PROCESS DESCRIPTION

_____

_____

_____

_____

_____

_____

_____

_____

3) WASTE CHARACTERISTICS

% Domestic: _____
% Commercial: _____
% Industrial: _____
% Institutional: _____
% Infiltration: _____

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Design Flow (m^3/day): _____
Average Flow (m^3/day): _____
Maximum Flow (m^3/day): _____

BOD Design Load (kg/day): _____

4) PRIMARY TREATMENT

Primary Treatment Code: _____

Number of Clarifiers: _____
Total Clarifier Surface Area (m^2): _____

Primary Sludge Pumping Frequency (#/day): _____
Duration (hrs/day): _____
Rate (m^3/day): _____

Primary Sludge Volatile Solids (%): _____

5) BIOLOGICAL TREATMENT

Biological Treatment Code: _____

Average Mixed Liquor SS (mg/L): _____
Average Mixed Liquor VSS (mg/L): _____

Return Activated Sludge SS (mg/L): _____
Return Activated Sludge Flow (m^3/d): _____

Waste Activated Sludge SS (mg/L): _____
Waste Activated Sludge Flow (m^3/d): _____

Phosphorus Removal Code: _____

Chemical Addition Code: _____
Dosage Rate (mg/L): _____

6) ANAEROBIC DIGESTION

Sludge Processing Code: _____

A. DESIGN CHARACTERISTICS

Number of Anaerobic Digesters: _____
Type (1 or 2 Stage): _____

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	STAGE 1	STAGE 2
Design Hydraulic Retention Time (day)		
Design Loading Rate (kg VS/m^3/d)		
Design Loading Rate (kg COD/m^3/d)		
Total Volume (m^3)		
Active Volume (m^3)		
Digester Height (m)		
Digester Diameter (m)		
Construction Material		
Insulation Type & R Value		
Insulation Thickness (cm)		
Design Operating Temperature (C)		

Digester Heating System (brief description): _____

Recirculation Rates (if any): _____

Estimated Heat Demand:

Waste Heating (GJ/day): _____
Digester Shell Losses (GJ/day): _____

Digester Mixing System (brief description): _____

Digester Mixing Energy Input (kW): _____

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B. DIGESTER OPERATIONAL PARAMETERS

Primary Sludge Loading (m^3/day): _____

Waste Activated Sludge Loading (m^3/day): _____

Average Influent BOD_5 (mg/L): _____
Average Effluent BOD_5 (mg/L): _____

Average Influent SS (mg/L): _____
Average Effluent SS (mg/L): _____

Digester Content:
Total Solids (%): _____
Volatile Solids (%): _____
Volatile Acids (mg/L): _____
Alkalinity (mg/L): _____
pH: _____

C. BIOGAS PRODUCTION

Biogas Production (m^3/day): _____
Biogas Quality (% methane): _____

Biogas Storage in Digestion Tank (m^3): _____
Storage Pressure (kPa): _____

External Biogas Storage (m^3): _____
Storage Pressure (kPa): _____

D. BIOGAS UTILIZATION

Biogas Use:
Boiler: _____
I.C. Engine: _____
Other (please specify): _____

If Boiler:
Boiler Size: _____
Boiler Type: _____
Manufacturer: _____

Other Fuels Boiler Operates With: _____

Yearly Consumption of Alternative Fuels (specify for each fuel used): _____

Current Purchase Costs of Alternative Fuels (specify for each fuel used): _____

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Boiler Use(s): _____

If Engine:

Engine Size: _____
Engine Type: _____
Manufacturer: _____

Other Fuels Engine Operates With: _____

Yearly Consumption of Alternative Fuels (specify for each fuel used): _____

Current Purchase Costs of Alternative Fuels (specify for each fuel used): _____

Engine Use (Electric Power Generation, Pumping, Other): _____

Electric Power Generation (kW/d): _____

Estimated Engine Heat Recovery (kJ/d): _____

Heat Recovery Source: _____

If Other:

Explain: _____

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APPENDIX B

MUNICIPAL ANAEROBIC DIGESTION FACILITIES IN CANADA

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TABLE B-1. PLANT STATUS

NO.	PLANT	ADDRESS	STATUS
0001	Spaniards Bay #1	Spaniards Bay, Nfld	unknown
0002	Spaniards Bay #2	Spaniards Bay, Nfld.	unknown
0003	Wabush WTF	Wabush, Newfoundland	active
0004	Charlottetown WPCP	Riverside Drive, Parkdale, P.E.I.	unknown
0005	Mill Cove WPCP	Mill Cove, Bedford, Nova Scotia	active
0006	Brookfield STP	Brookfield, N.S.	inactive
0007	Lakeside Timberlea STP	Riverview Drive, Lakeside Timberlea, Nova Scotia	active
0008	East River WPCP	Glass St. Trenton, New Glasgow Trenton, N.S.	inactive
0009	Oromocto	Bldg. B18, CFB Gagetown, New Brunswick	active
0010	Usine D'Epuration Regional	P.O. Box 577, Gatineau, Quebec, J8P 7A2	active
0011	Usine D'Epuration	Rue Chauvi, Boisbriand, Quebec	unknown
0012	Usine Epuration	Bois des Filion, Quebec	inactive
0013	Usine D'Epuration	1401 boulevard du Lac, Deux Montagnes, Quebec	active
0014	Usine D'Epuration	Montee Sagala, Ile-Perrot, Quebec	inactive
0015	Usine Dep. de St. Francois	4325 Charbonneau, Laval, Quebec	unknown
0016	Usine Dep. D'Auteuil	8890 Bl. Laurentides, Laval, Quebec	unknown

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TABLE B-1. PLANT STATUS

NO.	PLANT	ADDRESS	STATUS
0017	Usine Dep. de Ste. Dorothee	666 Jaroin, Ste. Dorothee, Laval, Quebec	unknown
0018	Usine Dep. de Duvernay	3420 Ch. Haut, St. Francois, Laval, Quebec	unknown
0019	Usine Dep. de Laval-Quest	3435 Riviera, Laval, Quebec	unknown
0020	Usine D'Epuration	1 iere Rue, Paspebiac, Quebec	unknown
0021	Usine de Traitment	747 Cardinal Leger, Pincourt, Quebec	inactive
0022	Usine D'Epuration	2875 St. Germain, Plessisville, Quebec	inactive
0023	Usine D'Epuration	Route St. Louis, Paroisse Princeville, Quebec	inactive
0024	Usine D'Epuration	1000 Principale, St. Etienne de Gres, Quebec	inactive
0025	Usine de Traitement	Rue St. Louis, St. Eustache, Quebec	inactive
0026	Usine D'Epuration	Edouard, St. Jean de Matha, Quebec	inactive
0027	Usine D'Epuration	Cite des Jeunes, Vaudreuil, Quebec	inactive
0028	Barrie WPCP	249 Bradford Street, Barrie, Ontario	active
0029	Belleville WPCP	Saint Paul St., Belleville, Ontario	active
0030	Brantford WPCP	Mohawk Rd., Brantford, Ontario	active
0031	Brockville WPCP	King St. E., Brockville, Ontario	active

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TABLE B-1. PLANT STATUS

NO.	PLANT	ADDRESS	STATUS
0032	Preston WPCP	Montrose St. S., Cambridge Preston, Ontario	active
0033	Galt WPCP	Water St. S., Box 253, Cambridge (G), Ontario, N1R 5T8	active
0034	Campbellford WPCP	Trent Dr., P.O. Box 510, Campbellford, Ontario, K0L 1L0	active
0035	Chatham WPCP	100 Irwin St., Box 640, Chatham, Ontario, N7M 5K8	active
0036	Cobourg WPCP #1	420 King St. W., Cobourg, Ontario	active
0037	Collingwood WPCP	3 Birch St. Collingwood, Ontario	active
0038	Cornwall WPCP	P.O. Box 2020, Cornwall, Ontario, K6H 6N8	active
0039	Long Sault WPCP	Long Sault, Ontario	unknown
0040	Dundas King St. WPCP	135 King St. E., Dundas, Ontario	inactive
0041	North Toronto Plant	439 University Ave., 10th Floor, East York, Ontario, M5G 1Y8	active
0042	Espanola WPCP	Golf Course Road, Espanola, Ontario	unknown
0043	Humber Plant	130 The Queensway, Etobicoke, Ontario	active
0044	Fergus WPCP	350 Queen St. W, P.O. Box 31, Fergus, Ontario, N1M 2W7	active
0045	Waterdown WPCP	Main Street, Waterdown, Ontario	inactive

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TABLE B-1. PLANT STATUS

NO.	PLANT	ADDRESS	STATUS
0046	Anger Ave. Plant	Anger Ave., Fort Erie, Ontario	unknown
0047	Fort Frances WPCP	Box 337, Fort Frances, Ontario	active
0048	Baker Rd. WPCP	1 Baker Rd., Grimsby, Ontario	unknown
0049	Guelph WPCP	29 Waterworks Place, Guelph, Ontario	active
0050	Caledonia Plant	Caledonia, Ontario	unknown
0051	Georgetown WPCP	1151 Bronte Rd, P.O. 7000, Oakville, Ontario, L6J 6E1	active
0052	Acton WPCP	Churchill Rd. S., Acton, Ontario	active
0053	Woodward Ave., WPCP	700 Woodward Ave., Hamilton	unknown
0054	Hanover WPCP	720-7th Ave., Hanover, Ontario, N4N 2K1	active
0055	Huntsville WPCP	Hunstville, Ontario	unknown
0056	Ingersoll WPCP	McKeand, Ingersoll, Ontario	unknown
0057	Kingston WPCP	Ravensview, Pittsburgh Township, Ontario	unknown
0058	Kingston WPCP	475 Front Road, Kingston, Ontario	inactive
0059	Kitchener WPCP	368 Mill Park Drive, Box 32, Kitchener, Ontario, N2 3W9	active
0060	Marathon WPCP	Marathon, Ontario	unknown

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TABLE B-1. PLANT STATUS

NO.	PLANT	ADDRESS	STATUS
0061	Midland WPCP	575 Dominion Ave., Midland, Ontario, L4R 1R2	active
0062	Milton WPCP	161 Fulton St., Milton, Ontario	active
0063	Lakeview WPCP	920 East Ave., Mississauga, Ontario, L5E 1W6	active
0064	Clarkson WPCP	920 East Ave., Mississauga, Ontario, L5E 1W6	active
0065	Mount Forest WPCP	Box 301 Queen St., Mount Forest, Ontario	unknown
0066	Napanee WPCP	300 Water St., Napanee, Ontario	active
0067	Watts Creek WPCP	Box 11053 Stn. H., Shirley Bay, Ontario, K2H 7T8	active
0068	Port Darlington WPCP	Liberty St., Newcastle, Ontario	active
0069	Newmarket WPCP	Bayview Ave. N., Newmarket, Ontario	inactive
0070	Stamford WPCP	3450 Stanley Ave., Niagara Falls, Ontario	active
0071	Coniston STP	Government Rd., Coniston, Ontario	inactive
0072	North Bay WPCP	650 Queen St., North Bay, Ontario	unknown
0073	South West WPCP	1385 Lakeshore Rd., Oakville, Ontario	active
0074	Onaping WPCP	Walden Dump Rd., Onaping, Ontario	unknown

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TABLE B-1. PLANT STATUS

NO.	PLANT	ADDRESS	STATUS
0075	Orangeville WPCP	Box 104, 10 Townline E., Orangeville, Ontario, L9W 2Z5	active
0076	Orillia WPCP	Kitchener St.,. Orillia, Ontario	active
0077	Harmony Cr. WPCP	Farewell Ave. Oshawa, Ontario	active
0078	Ingleside WPCP	Box 340, Ingleside, Ontario	unknown
0079	Green Creek WPCP	Shefford Rd., Ottawa, Ontario	active
0080	Owen Sound WPCP	Owen Sound, Ontario	unknown
0081	Parry Sound WPCP	Parry Sound, Ontario	unknown
0082	Pembroke WPCP	Rankin St., Pembroke, Ontario	active
0083	Point Edward WPCP	Box 2319, Sarnia, Ontario, N7T 7L7	active
0084	Port Hope WPCP	Lake Road, Port Hope Ontario	active
0085	Edwardsburg WPCP	HWY 2 E., Prescott, Ontario	active
0086	Red Rock WPCP	Salls Street, Red Rock, Ontario	unknown
0087	Sarnia WPCP	333 St. Andrew St., Sarnia, Ontario	active
0088	Highland Creek Plant	51 Beechgrove Dr., Scarborough, Ontario, M1E 3Z3	active
0089	Simcoe WPCP	16 Oakwood Ave., Box 225, Simcoe, Ontario N3P 4L1	active

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TABLE B-1. PLANT STATUS

NO.	PLANT	ADDRESS	STATUS
0090	Smiths Falls WPCP	HWY 43 South Queen, Smiths Falls, Ontario	unknown
0091	Stratford WPCP	701 West Gore St., Stratford, Ontario	active
0092	Sturgeon Falls WPCP	Box 1960, Sturgeon Falls, Ontario, P0H 2G0	active
0093	Port Dalhousie WPCP	40 Michigan Ave., St. Catharines, Ontario	active
0094	Port Weller WPCP	Lombardy St., St. Catharines, Ontario	unknown
0095	St. Thomas WPCP	Southwald St., St. Thomas, Ontario	active
0096	St. Mary WPCP	St. Mary, Ontario	unknown
0097	Thunder Bay WPCP	Atlantic Ave., Thunder Bay, Ontario	active
0098	Mattagami WPCP	220 Algonquin Blvd., Timmins, Ontario, P4N 1B3	active
0099	Toronto - Main Plant	Lakeshore Rd., Toronto, Ontario	unknown
0100	Trenton WPCP	Bay Street, Box 321, Trenton, Ontario	unknown
0101	Uxbridge Brook WPCP	Main St., Uxbridge, Ontario	inactive
0102	Valley East WPCP	Hydro Access Rd., Val Caron, Ontario	active
0103	Walkerton WPCP	Box 844, Walkerton, Ontario, N0G 2V0	active
0104	Wallaceburg WPCP	Wallaceburg, Ontario	unknown

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TABLE B-1. PLANT STATUS

NO.	PLANT	ADDRESS	STATUS
0105	Waterloo WPCP	University Ave. W., Waterloo, Ontario, N2J 3Z9	active
0106	Welland WPCP	505 River Rd., Welland, Ontario, L3B 5P4	active
0107	Pringle Creek WPCP No. 1	Victoria St., Whitby, Ontario	active
0108	Stouffville WPCP	Park Dr. S., Stouffville, Ontario	inactive
0109	Hornepayne WPCP	Box 370, Hornepayne, Ontario	inactive
0110	Elmira WPCP	Box 131, First St. E. Ext., Elmira, Ontario N3B 2Z5	inactive
0111	Gimli Ind. Park WTP	Gimli, Manitoba	active
0112	Thompson WTP	Thompson, Manitoba	unknown
0113	Northend WPCC	2230 Main St., Winnipeg, Manitoba	active
0114	North Battleford WWTP	City Hall, P.O. Box 460, North Battleford, Saskatchewan	active
0115	Regina WWTP	Public Works, Box 1790, Regina, Saskatchewan, S4P 3C8	active
0116	H. McIvor Wier WPCP	Saskatoon, Saskatchewan	active
0117	Fish Creek STP	Box 2100, Calgary, Alberta	active
0118	Bonnybrook STP	4302-15 St. S.E., Calgary, Alberta	active

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TABLE B-1. PLANT STATUS

NO.	PLANT	ADDRESS	STATUS
0119	Gold Bar WWTP	10977-50 St., Edmonton, Alberta	active
0120	Village of Legal	Box 28, Legal, Alberta	unknown
0121	City of Lethbridge	910 Ave. S., Lethbridge, Alta.	unknown
0122	Red Deer WTP	7890 40 Ave., Red Deer, Alberta, T4N 2W8	active
0123	Town of Turner Valley	Turner Valley, Alta.	unknown
0124	Kimberley City	340 Spokane, Kimberley, B.C.	inactive
0125	Regional District of Nanaimo	Box 40, Lantzville, B.C.	active
0126	Nelson City	502 Vernon St., Nelson, B.C., V1L 4E8	active
0127	Lions Gate STP	North Vancouver, B.C.	unknown
0128	City of Penticton	171 Main St., Penticton, B.C., V2A 5A9	unknown
0129	District of Terrace	3215 Eby St., Terrace, B.C.	unknown
0130	David S. Mackay Env. Centre	4302 25th Ave., Vernon, B.C.	active
0131	Skyway WPCP	1125 Lakeshore Rd. Burlington, Ontario	active
0132	Peterborough WPCP	City Hall, 500 George St., Peterborough, Ontario, K9H 3R9	active

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TABLE B-2. PLANT ADDRESS *

NAME	ADDRESS	ATTENTION	PHONE NO.
Wabush WTF	Wabush, Newfoundland	Taylor, Ralph	7092825696
Mill Cove WPCP	Mill Cove, Bedford, Nova Scotia	Brady, Alan	9028358035
Lakeside Timberlea STP	Riverview Drive, Lakeside Timberlea, Nova Scotia	Lynch, Doug	9028762587
Oromocto	Bldg. B18, CFB Gagetown, New Brunswick	Hancox, W.R.	5064222672
Usine D'Epuration Regional	P.O. Box 577, Gatineau, Quebec, J8P 7A2	St. Onge, Jean-Paul	8196635585
Usine D'Epuration	1401 boulevard du Lac, Deux Montagnes, Quebec	Dumoulin, Gilles	5144734688
Barrie WPCP	249 Bradford St., Barrie, Ontario	Gemmell, Ronald	7057264242
Belleville WPCP	Saint Paul St., Belleville, Ontario	Wilkinson, Harold	6139625454
Brantford WPCP	Mohawk Rd., Brantford, Ontario	Fiddy, Charlie	5197565957
Brockville WPCP	King St. E., Brockville, Ontario	Arcand, Roger	6133451189
Preston WPCP	Montrose St. S., Cambridge Preston, Ontario	Hickman, Bob	5196535645
Galt WPCP	Water St. S., Box 253, Cambridge (G), Ontario, N1R 5T8	Middleton, Gary	5196230071
Cambellford WPCP	Trent Dr., Box 510 Campbellford, Ontario, K0L 1L0	Bluett, A.R.	7056531870

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TABLE B-2. PLANT ADDRESS

NAME	ADDRESS	ATTENTION	PHONE NO.
Chatham WPCP	100 Irwin St., Box 640, Chatham, Ontario, N7M 5K8	Sonneveld, Jack	5193521971
Cobourg WPCP #1	420 King St. W., Cobourg, Ontario	Davey, Brian	4163727332
Collingwood WPCP	3 Birch St. Collingwood, Ontario	Green, Don	7054451631
Cornwall WPCP	P.O. Box 2020, Cornwall, Ontario K6H 6N8	Girard, W.J.	6139335157
North Toronto Plant	439 University Ave., 10th Floor, East York, Ontario, M5G 1Y8	Smith, Andrew	4164218888
Humber Plant	130 The Queensway, Etobicoke, Ontario	Cook, J.H.	4163922382
Fergus WPCP	350 Queen St. W, P.O. Box 31, Fergue, Ontario, N1M 2W7	Van Zutphen, Bill	5198432180
Fort Frances WPCP	Box 337, Fort Frances, Ontario	Sletmoen, Robert	8072743121
Guelph WPCP	29 Waterworks Place, Guelph, Ontario	Sanvido, John	5198375627
Georgetown WPCP	1151 Bronte Rd, Box 7000, Oakville, Ontario, L6J 6E1	Yust, Len	4168788113
Acton WPCP	Churchill Rd. S., Acton, Ontario	Yust, Len	4168530501
Hanover WPCP	720-7th Ave., Hanover, Ontario, N4N 2K1	Rouw, Bram	5193641481
Kitchener WPCP	Mill Park Drive, Box 32, Kitchener, Ontario, N2G 3W9	Edwards, Larry	5198933880

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TABLE B-2. PLANT ADDRESS

NAME	ADDRESS	ATTENTION	PHONE NO.
Midland WPCP	575 Dominion Ave., Midland, Ontario, L4R 1R2	Murray, Jim	7055264275
Milton WPCP	161 Fulton St., Milton, Ontario	Yust, Len	4168786171
Lakeview WPCP	920 East Ave., Mississauga, Ontario, L5E 1W6	Lewis, D.A.	4162741223
Clarkson WPCP	920 East Ave., Mississauga, Ontario, L5E 1W6	Srebotnjak, Andy	4168222782
Napanee WPCP	300 Water St., Napanee, Ontario	Gelsomino, Sal	6133549338
Watts Creek WPCP	Box 11053 Stn. H., Shirley Bay, Ontario, K2H 7T8	Aubichon, S.L.	6138288378
Port Darlington WPCP	Liberty St., Newcastle, Ontario	Mackey, Bill	4166237937
Stamford WPCP	3450 Stanley Ave., Niagara Falls, Ontario	Starrs, William	4163542754
South West WPCP	1385 Lakeshore Rd., Oakville, Ontario	Yust, Len	4168272151
Orangeville WPCP	Box 104, 10 10 Townline E., Orangeville, Ontario, L9W 2Z5	West, Ralph	5199411830
Orillia WPCP	Kitchener St., Orillia, Ontario	Dehart, Eric	7053251311
Harmony Cr. WPCP	Farewell Ave., Oshawa, Ontario	Rupke, Peter	4167289423
Green Creek WPCP	Shefford Rd., Ottawa, Ontario	Scott, Nancy	6137457165
Pembroke WPCP	Rankin St., Pembroke, Ontario	McMullan, John	6137350409

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TABLE B-2. PLANT ADDRESS

NAME	ADDRESS	ATTENTION	PHONE NO.
Point Edward WPCP	Box 2319, Sarnia, Ontario, N7T 7L7	Brook, Chris	5193378731
Port Hope WPCP	Lake Road, Port Hope, Ontario	Walsh, Alan	4168854762
Edwardsburg WPCP	HYW 2 E., Prescott, Ontario	Vanderwoude, Pete	6139255115
Sarnia WPCP	333 St. Andrew St., Sarnia, Ontario	Burns, Jack	5193448507
Highland Creek Plant	51 Beechgrove Dr., Scarborough, Ontario, M1E 3Z3	Hsu, C.	4163922353
Simcoe WPCP	16 Oakwood Ave., Box 225, Simcoe, Ontario, N3Y 4L1	Seib, Heinz	5194264712
Stratford WPCP	701 West Gore St., Stratford, Ontario	Gotts, Jack	5192719071
Sturgeon Falls WPCP	Box 1960, Sturgeon Falls, Ontario, P0H 2G0	Michaud, Don	7057533210
Port Dalhousie WPCP	40 Michigan Ave., St. Catharines, Ontario	McNamara, John	4166851571
St. Thomas WPCP	Southwald St., St. Thomas, Ontario	Coombes, Clark	5196311680
Thunder Bay WPCP	Atlantic Ave., Thunder Bay, Ontario	Romanick, Russ	8076252471
Mattagami WPCP	220 Algonquin Blvd., Timmins, Ontario, P4N 1B3	Drouin, Real	7052686006
Valley East WPCP	Hydro Access Rd., Val Caron, Ontario	Grenier, Ray	7058975374
Walkerton WPCP	Box 844, Walkerton, Ontario, N0G 2V0	Stratton, Ken	5198810363

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TABLE B-2. PLANT ADDRESS

NAME	ADDRESS	ATTENTION	PHONE NO.
Waterloo WPCP	University Ave. W., Waterloo, Ontario, N2J 3Z9	Ranton, Reginald	5198840260
Welland WPCP	505 River Rd., Welland, Ontario, L3B 5P4	Holowacz, W.	4167352110
Pringle Creek WPCP No. 1	Victoria St., Whitby, Ontario	Scott, Alex	4166683638
Gimli Ind. Park WTP	Gimli, Manitoba	Fleishman, Brian	2046425210
Northend WPCC	2230 Main St., Winnipeg, Manitoba	Cassiram, M.	2043380308
North Battleford WWTP	City Hall, Box 460, North Battleford, Saskatchewan	Thompson, R.J.	3064459431
Regina WWTP	Public Works, Box 1790, Regina, Saskatchewan, S4P 3C8	Bellows, D.	3065697440
H. McIvor Wier WPCP	Saskatoon, Saskatchewan	Hwang, C.P.	3066649541
Fish Creek STP	Box 2100, Calgary, Alberta	Huck, B.C.	4032788120
Bonnybrook STP	4302-15 St. S.E., Calgary, Alberta	Meckleborg, E.I.	4032655575
Gold Bar WWTP	10977-50 St., Edmonton, Alberta	Elstone, Ken	4034288359
Red Deer WTP	7890 40 Ave., Red Deer, Alberta, T4N 2W8	Thorson, Doug	4033428251
Regional District of Nanaimo	Box 40, Lantzville, B.C.	Swanson, Bob	6047581157

TABLE B-2. PLANT ADDRESS

NAME	ADDRESS	ATTENTION	PHONE NO.
Nelson City	502 Vernon St., Nelson, B.C., V1L 4E8	Gilfillan, E.	6043529345
David S. Mackay Env. Centre	4302 25th Ave., Vernon, B.C.	Jackson, Eric	6045451361
Skyway WPCP	1125 Lakeshore Rd., Burlington, Ontario	Yust, Leonard	4168272151
Peterborough WPCP	City Hall, 500 George St., Peterborough, Ontario, K9H 3R9	Norand, Lloyd	7057433031

* only those plants with an active anaerobic digestion system have been included.

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TABLE B-3. PROCESS DESCRIPTION *

NO.	FACILITY NAME	DESCRIPTION
0003	Wabush WTF	BAR SCR/GRT REM/P CLAR/COM/HRAS/ ** ANAER
0005	Mill Cove WPCP	BAR SCR/GRT REM/P CLAR/COM/HRAS/S CLAR/CL/ANAER
0007	Lakeside Timberlea STP	BAR SCR/GRT REM/RBC/NIT/P REM/CL/ AER/ANAER
0009	Oromocto	BAR SCR/GRT REM/COM/AS/CL/ANAER
0010	Usine D'Epuration Regial	BAR SCR/GRT REM/P CLAR/AER/ANAER/SL CENT
0013	Usine D'Epuration	BAR SCR/P CLAR/AS/S CLAR/ANAER
0028	Barrie WPCP	BAR SCR/GRT REM/HRAS/P REM/FILT/ ANAER
0029	Belleville WPCP	BAR SCR/GRT REM/P CLAR/COM/AS/P REM/ANAER
0030	Brantford WPCP	BAR SCR/GRT REM/P CLAR/AS/P REM/ ANAER
0031	Brockville WPCP	BAR SCR/GRT REM/P CLAR/COM/FAC/P REM/ANAER/SL DR BD
0032	Preston WPCP	BAR SCR/GR REM/AS/P REM/P CLAR/S CLAR/ANAER
0033	Galt WPCP	BAR SCR/COM/GRT REM/P CLAR/AS/P REM/S CLAR/CL/ANAER
0034	Cambellford WPCP	BAR SCR/GRT REM/P CLAR/COM/AS/S CLAR/ANAER/CL
0035	Chatham WPCP	BAR SCR/GRT REM/P CLAR/COM/AS/AER/P REM/ANAER
0036	Cobourg WPCP #1	BAR SCR/GRT REM/P CLAR/HRAS/SL THICK/ANAER
0037	Collingwood WPCP	BAR SCR/GRT REM/CLAR/COM/P REM/ ANAER
0038	Cornwall WPCP	BAR SCR/GRT REM/P CLAR/COM/P REM/ ANAER/SL THICK

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TABLE B-3. PROCESS DESCRIPTION

NO.	FACILITY NAME	DESCRIPTION
0041	North Toronto Plant	BAR SCR/GRT REM/P CLAR/AS/P REM/ ANAER
0043	Humber Plant	BAR SCR/GRT REM/P CLAR/AS/P REM/CL
0044	Fergus WPCP	BAR SCR/GRT REM/P CLAR/AS/P REM/ ANAER
0047	Fort Frances WPCP	BAR SCR/GRT REM/P CLAR/COM/CL/ANAER
0049	Guelph WPCP	GRT REM/P AR/AS/NIT/ANEAR
0051	Georgetown WPCP	AS/COM/GRT REM/P CLAR/S CLAR/CL/P REM/ANAER
0052	Acton WPCP	BAR SCR/GRT REM/P CLAR/AS/S CLAR/ CL/ANAER
0054	Hanover WPCP	BAR SCR/GRT REM/P CLAR/AS/ANAER
0059	Kitchener WPCP	BAR SCR/GRT REM/P CLAR/COM/AS/P REM/ANAER
0061	Midland WPCP	BAR SCR/GRT REM/P CLAR/COM/P REM/ AS/ANAER/SL FILT
0062	Milton WPCP	BAR SCR/GRT REM/P CLAR/AS/P REM/S CLAR/NIT/CL/ANAER
0063	Lakeview WPCP	BAR SCR/GRT REM/P CLAR/AS/P REM/ ANAER/THERM/SL INC/SL CENT
0064	Clarkson WPCP	BAR SCR/GRT REM/AS/P REM/ANAER
0066	Napanee WPCP	BAR SCR/GRT REM/COM/P CLAR/P REM/ ANAER
0067	Watts Creek WPCP	BAR SCR/GRT REM/P CLAR/HRAS/P REM/ ANAER
0068	Port Darlington WPCP	BAR SCR/GRT REM/P CLAR/AS/P REM/ ANAER
0070	Stamford WPCP	GRT REM/AER/P CLAR/RBC/P REM/ANAER
0073	South West WPCP	BAR SCR/GRT REM/P CLAR/COM/AS/P REM/ANAER

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TABLE B-3. PROCESS DESCRIPTION

NO.	FACILITY NAME	DESCRIPTION
0075	Orangeville WPCP	GRT REM/P CLAR/AS/P REM/DNIT/NIT/ TF/ANAER
0076	Orillia WPCP	BAR SCR/GRT REM/P CLAR/AS/P REM/CL/ ANAER
0077	Harmony Cr. WPCP	BAR SCR/GRT REM/P CLAR/TF/P REM/ ANAER
0079	Green Creek WPCP	BAR SCR/GRT REM/P CLAR/CL/COAG/ ANAER
0082	Pembroke WPCP	BAR SCR/GRT REM/P CLAR/AER/P REM/SL THICK/CL/ANAER
0083	Point Edward WPCP	BAR SCR/GRT REM/P CLAR/ANAER/P REM
0084	Port Hope WPCP	BAR SCR/GRT REM/P CLAR/COM/AS/HRAS/ P REM/CL/ANAER
0085	Edwardsburg WPCP	BAR SCR/GRT REM/P CLAR/COM/P REM/ ANAER/CL
0087	Sarnia WPCP	BAR SCR/GRT REM/P CLAR/P REM/ANAER
0088	Highland Creek Plant	GRT REM/BAR SCR/P CLAR/AS/P REM/ FLO/ANAER/THERM/SL CENT/INC/OZO
0089	Simcoe WPCP	GRT REM/P CLAR/COM/AS/P REM/CL/ ANAER/SL FILT
0091	Stratford WPCP	BAR SCR/GRT REM/P CLAR/COM/AS/P REM/CL/ANAER
0092	Sturgeon Falls WPCP	GRT REM/P CLAR/COM/AS/P REM/ANAER
0093	Port Dalhousie WPCP	BAR SCR/GRT REM/P CLAR/AS/P REM/ ANAER
0095	St. Thomas WPCP	AS/P REM/ANAER
0097	Thunder Bay WPCP	BAR SCR/GRT REM/P CLAR/ANAER/P REM/ CL
0098	Mattagami WPCP	BAR SCR/GRT REM/P CLAR/ANAER
0102	Valley East WPCP	BAR SCR/GRT REM/P CLAR/AS/OD/ANAER

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TABLE B-3. PROCESS DESCRIPTION

NO.	FACILITY NAME	DESCRIPTION
0103	Walkerton WPCP	BAR SCR/COM/GRT REM/P CLAR/AS/CL/ ANAER/P REM
0105	Waterloo WPCP	GRT REM/P CLAR/COM/AS/P REM/ANAER
0106	Welland WPCP	BAR SCR/EQUAL/GRT REM/P CLAR/AS/P REM/AER/S CLAR/CL/ANAER
0107	Pringle Creek WPCP No. 1	BAR SCR/GRT REM/P CLAR/AS/P REM/ ANAER
0111	Gimli Ind. Park WTP	BAR SCR/P CLAR/TF/ANAER
0113	Northend WPCC	BAR SCR/GRT REM/P CLAR/AER/AS/ANAER
0114	North Battleford WWTP	BAR SCR/GRT REM/P CLAR/COM/AER/AS/S CLAR/CL/ANAER
0115	Regina WWTP	BAR SCR/GRT REM/P CLAR/ANAER/SL THICK/AER LAG/P REM
0116	H. McIvor Wier WPCP	GRT REM/BAR SCR/P CLAR/AER/CL/ ANAER/LAG
0117	Fish Creek STP	BAR SCR/G REM/P CLAR/ANAER
0118	Bonnybrook STP	BAR SCR/GRT REM/P CLAR/COM/AS/SL THICK/ANAER/P REM
0119	Gold Bar WWTP	GRT REM/BAR SCR/P CLAR/AS/AER/S CLAR/ANAER/LAG
0122	Red Deer WTP	BAR SCR/GT REM/P CLAR/HRAS/ANAER
0125	Regional District of Nanaimo	BAR SCR/GRT REM/P CLAR/ANAER/SL DR BD
0126	Nelson City	BAR SCR/GRT REM/P CLAR/COM/ANAER
0130	David S. Mackay Env. Centre	BAR SCR/GRT REM/P CLAR/TF/P REM/CL/ ANAER
0131	Skyway WPCP	BAR SCR/GRT REM/P CLAR/AS/S CLAR/ CL/ANAER
0132	Peterborough WPCP	BAR SCR/P CLAR/AS/S CLAR/ANAER

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* only those plants with an active anaerobic digestion system have been included.

** AER - aerated
AER LAG - aerated lagoon
ANAER - anaerobic
AS - activated sludge
BAR SCR - bar screen
CL - disinfected with chlorine
COM - comminution
DNIT - denitrification
EA - extended aeration
EQUAL - equalization
FAC - facultative
GRT REM - grit removal
HRAS - high rate activated sludge
INC - inceneration
LAG - lagoon
NIT - nitrification
OD - oxidation ditch
OZO - ozone
P CLAR - primary clarification
P REM - phosphorus removal
RBC - rotating biological contactor
S CLAR - secondary clarification
SL CENT - sludge centrifuge
SL DR BD - sludge drying beds
SL FILT - sludge filtration
SL INC - sludge inceneration
SL THICK - sludge thickeners
TF - trickling filter

\- codes used in the "National Inventory of Municipal Waterworks and Wastewater Systems in Canada 1981".

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TABLE B-4. FLOW CHARACTERISTICS *

NO.	FACILITY NAME	POPULATION	DESIGN FLOW (m^3/d)	AVERAGE FLOW (m^3/d)	MAXIMUM FLOW (m^3/d)	DESIGN BOD (kg/d)
0003	Wabush WTF	-	3268	3768	-	-
0005	Mill Cove WPCP	30000	18925	13245	-	3630
0007	Lakeside Timberlea STP	2500	2270	1820	4550	386
0009	Oromocto	12000	6815	5000	3000	-
0010	Usine D'Epuration	170000	136000	111500	409000	17680
0013	Usine D'Epuration	11000	3785	7570	37850	450
0028	Barrie WPCP	43000	27239	21519	46370	26640
0029	Belleville WPCP	37200	163656	44883	144799	6818
0030	Brantford WPCP	76000	81828	52500	70900	14729
0031	Brockville WPCP	21000	21818	16169	34752	2509
0032	Preston WPCP	20000	16843	9310	23500	7938
0033	Galt WPCP	75000	38589	29914	75910	9647
0034	Cambellford WPCP	3500	5901	4993	-	1182
0035	Chatham WPCP	41000	35870	27920	-	8968
0036	Cobourg WPCP #1	6000	16026	8308	20912	6630
0037	Collingwood WPCP	12000	24548	15808	86374	4910
0038	Cornwall WPCP	48000	37454	55387	91000	4875
0041	North Toronto Plant	100000	45399	38635	40000	-
0043	Humber Plant	600000	413686	409000	1022727	168784
0044	Fergus WPCP	6500	4993	2950	9400	472
0047	Fort Frances WPCP	8500	9079	9533	18000	1180
0049	Guelph WPCP	80000	54552	47724	115000	8610
0051	Georgetown WPCP	21000	13619	10895	15700	2322
0052	Acton WPCP	7000	5479	4106	7790	907
0054	Hanover WPCP	6500	6364	4270	11790	834
0059	Kitchener WPCP	150000	122579	68410	129651	18810
0061	Midland WPCP	12500	13600	11000	22700	-
0062	Milton WPCP	22000	12893	12000	22000	2582
0063	Lakeview WPCP	370000	278500	239580	343800	85200
0064	Clarkson WPCP	150000	109000	81000	120000	15590
0066	Napanee WPCP	7500	9079	7263	18000	-
0067	Watts Creek WPCP	55000	29549	30500	42000	4423
0068	Port Darlington WPCP	15000	4539	5089	11040	1018
0070	Stamford WPCP	107050	68500	68200	136400	8280
0073	South West WPCP	40000	41428	34441	-	5167
0075	Orangeville WPCP	16500	14400	9000	34390	2880
0076	Orillia WPCP	24000	18182	19545	36363	5500
0077	Harmony Cr. WPCP	140000	34045	27000	46830	6500
0079	Green Creek WPCP	360000	545520	416600	698000	29942
0082	Pembroke WPCP	16000	22700	13500	14775	4540
0083	Point Edward WPCP	2500	2587	2133	-	440
0084	Port Hope WPCP	9000	9079	8834	22730	225
0085	Edwardsburg WPCP	4800	5683	5171	14243	259
0087	Sarnia WPCP	70000	68190	56830	77280	11592
0088	Highland Creek Plant	310000	218000	170000	240000	54000

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TABLE B-4. FLOW CHARACTERISTICS

NO.	FACILITY NAME	POPULATION	DESIGN FLOW (m^3/d)	AVERAGE FLOW (m^3/d)	MAXIMUM FLOW (m^3/d)	DESIGN BOD (kg/d)
0089	Simcoe WPCP	12500	14764	10441	20470	4607
0091	Stratford WPCP	26258	27239	18159	77272	-
0092	Sturgeon Falls WPCP	5500	4539	5580	14000	1004
0093	Port Dalhousie WPCP	-	61289	40909	122750	-
0095	St. Thomas WPCP	-	26820	17592	68180	-
0097	Thunder Bay WPCP	101775	108959	33096	817200	108864
0098	Mattagami WPCP	35000	34049	19067	32800	6137
0102	Valley East WPCP	16500	11400	4868	-	-
0103	Walkerton WPCP	4700	7560	5760	10290	1991
0105	Waterloo WPCP	68602	45399	4610	98850	12258
0106	Welland WPCP	-	54479	40878	118960	-
0107	Pringle Creek WPCP No. 1	-	14754	9125	13636	2509
0111	Gimli Ind. Park WTP	910	1588	544	-	-
0113	Northend WPCC	450000	827000	332000	827000	272910
0114	North Battleford WWTP	15000	6000	4545	9000	1360
0115	Regina WWTP	170000	90799	61516	158300	15500
0116	H. McIvor Wier WPCP	180000	90799	84916	122910	18700
0117	Fish Creek STP	162000	72736	69060	86320	10206
0118	Bonnybrook STP	481481	450000	344010	900000	65000
0119	Gold Bar WWTP	-	314621	240619	1200000	56787
0122	Red Deer WTP	55000	54545	32407	51979	16200
0125	Reg. Dist. of Nanaimo	55000	27239	20925	72727	4173
0126	Nelson City	9000	5674	7990	12000	1133
0130	David S. Mackay Env.	24000	13619	10441	14000	-
0131	Skyway WPCP	120000	92000	68000	110633	8050
0132	Peterborough WPCP	60000	163656	45460	113650	-

* only those plants with an active anaerobic digestion system have been included.

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TABLE B-5. WASTE CHARACTERISTICS *

NO.	FACILITY NAME	DOM. %	COM. %	IND. %	INS. %	INF. %	TOTAL** %
0003	Wabush WTF	100	0	0	0	0	100
0005	MilL Cove WPCP	61	21	6	0	12	100
0007	Lakeside Timberlea STP	60	20	10	0	10	100
0009	Oromocto	85	5	5	5	0	100
0010	Usine D'Epuration Regional	75	5	0	10	10	100
0013	Usine d'Epuration	90	10	0	0	0	100
0028	Barrie WPCP	60	13	13	14	0	100
0029	Belleville WPCP	49	13	13	0	25	100
0030	Brantford WPCP	30	10	30	5	25	100
0031	Brockville WPCP	-	-	-	-	-	-
0032	Preston WPCP	26	74	0	0	0	100
0033	Galt WPCP	-	-	-	-	-	-
0034	Cambellford WPCP	35	5	5	5	50	100
0035	Chatham WPCP	70	0	20	0	10	100
0036	Cobourg WPCP #1	9	45	46	0	0	100
0037	Collingwood WPCP	30	7	50	7	6	100
0038	Cornwall WPCP	-	-	-	-	-	-
0041	North Toronto Plant	-	-	-	-	-	-
0043	Humber Plant	-	-	-	-	-	-
0044	Fergus WPCP	51	10	39	0	0	100
0047	Fort Frances WPCP	65	20	0	5	10	100
0049	Guelph WPCP	50	[illegible]	25	12	10	100
0051	Georgetown WPCP	-	-	-	-	-	-
0052	Acton WPCP	-	-	-	-	-	-
0054	Hanover WPCP	50	10	28	5	7	100
0059	Kitchener WPCP	-	-	-	-	-	-
0061	Midland WPCP	60	4	20	8	8	100
0062	Milton WPCP	60	10	25	0	5	100
0063	Lakeview WPCP	40	25	25	0	10	100
0064	Clarkson WPCP	85	10	5	0	0	100
0066	Napanee WPCP	40	5	30	10	15	100
0067	Watts Creek WPCP	19	17	17	17	30	100
0068	Port Darlington WPCP	90	0	10	0	0	100
0070	Stamford WPCP	-	-	-	-	-	-
0073	South West WPCP	-	-	-	-	-	-
0075	Orangeville WPCP	80	5	5	5	5	100
0076	Orillia WPCP	35	25	25	5	10	100
0077	Harmony Cr. WPCP	70	0	20	0	10	100
0079	Green Creek WPCP	-	-	-	-	-	-
0082	Pembroke WPCP	70	15	10	2	3	100
0083	Point Edward WPCP	95	[illegible]	0	0	5	100
0084	Port Hope WPCP	80	0	18	0	2	100
0085	Edwardsburg WPCP	18	11	11	0	60	100
0087	Sarnia WPCP	96	2	1	1	0	100
0088	Highland Creek Plant	50	14	12	12	12	100
0089	Simcoe WPCP	70	0	30	0	0	100

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TABLE B-5. WASTE CHARACTERISTICS

NO.	FACILITY NAME	DOM. %	COM. %	IND. %	INS. %	INF. %	TOTAL** %
0091	Stratford WPCP	-	-	-	-	-	-
0092	Sturgeon Falls WPCP	80	20	0	0	0	100
0093	Port Dalhousie WPCP	-	-	-	-	-	-
0095	St. Thomas WPCP	-	-	-	-	-	-
0097	Thunder Bay WPCP	80	5	5	5	5	100
0098	Mattagami WPCP	-	-	-	-	-	-
0102	Valley East WPCP	98	0	0	0	2	100
0103	Walkerton WPCP	-	-	-	-	-	-
0105	Waterloo WPCP	70	10	10	10	0	100
0106	Welland WPCP	75	7	6	6	6	100
0107	Pringle Creek WPCP No. 1	40	0	50	0	10	100
0111	Gimli Ind. Park WTP	-	-	-	-	-	-
0113	Northend WPCC	70	0	30	0	0	100
0114	North Battleford WWTP	90	5	5	0	0	100
0115	Regina WWTP	60	20	20	0	0	100
0116	H. McIvor Wier WPCP	47	19	17	17	0	100
0117	Fish Creek STP	-	-	-	-	-	-
0118	Bonnybrook STP	-	-	-	-	-	-
0119	Gold Bar WWTP	66	8	7	7	12	100
0122	Red Deer WTP	38	20	20	20	2	100
0125	Regional District of Nanaimo	80	2	2	1	15	100
0126	Nelson City	-	-	-	-	-	-
0130	David S. Mackay Env. Centre	60	10	5	5	20	100
0131	Skyway WPCP	60	10	25	0	5	100
0132	Peterborough WPCP	75	0	25	0	0	100

* only those plants with an active anaerobic digestion system have been included

** DOM. = domestic
COM. = commercial
IND. = industrial
INS. = institutional
INF. = infiltration

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TABLE B-6. PRIMARY TREATMENT - CLARIFIERS *

NO.	FACILITY NAME	NO. CLAR.	SUR. AREA (m^2)	PUMP FREQ. (#/d)	PUMP DUR. (hr/d)	PUMP RATE (m^3/d)	VS (%)
0003	Wabush WTF	1	129	-	-	-	-
0005	Mill Cove WPCP	4	476	11	2.2	48	2.5
0007	Lakeside Timberlea STP	2	149	24	2.0	14	3.5
0009	Oromocto	2	180	8	3.0	80	-
0010	Usine D'Epuration	2	5100	1	24.0	275	2.0
0013	Usine D'Epuration	2	149	10	1.5	21	1.0
0028	Barrie WPCP	1	818	24	4.8	150	-
0029	Belleville WPCP	6	2804	-	9.5	96	2.9
0030	Brantford WPCP	6	2558	12	7.0	259	3.2
0031	Brockville WPCP	4	1167	48	-	39	1.4
0032	Preston WPCP	4	726	24	6.7	91	2.9
0033	Galt WPCP	4	1052	24	4.8	136	3.3
0034	Cambellford WPCP	2	234	21	1.0	9	2.5
0035	Chatham WPCP	2	476	-	-	124	2.4
0036	Cobourg WPCP #1	1	411	26	2.2	-	2.2
0037	Collingwood WPCP	3	531	-	-	39	1.6
0038	Cornwall WPCP	2	486	24	6.5	145	2.0
0041	North Toronto Plant	4	784	10	7.5	162	2.1
0043	Humber Plant	9	10482	6	19.5	1700	2.8
0044	Fergus WPCP	1	149	12	4.0	9	-
0047	Fort Frances WPCP	2	149	31	1.5	15	4.0
0049	Guelph WPCP	4	-	24	2.4	180	2.4
0051	Georgetown WPCP	4	230	24	0.6	75	2.7
0052	Acton WPCP	3	148	4	1.5	39	3.1
0054	Hanover WPCP	3	292	22	1.0	27	-
0059	Kitchener WPCP	4	4586	12	6.6	683	2.7
0061	Midland WPCP	2	26	24	0.6	35	2.6
0062	Milton WPCP	7	491	-	6.0	53	3.1
0063	Lakeview WPCP	8	-	1	24.0	1350	3.5
0064	Clarkson WPCP	2	3200	24	8.0	300	3.9
0066	Napanee WPCP	2	330	1	24.0	40	5.2
0067	Watts Creek WPCP	2	684	48	5.0	125	3.0
0068	Port Darlington WPCP	2	223	16	0.5	30	2.2
0070	Stamford WPCP	-	-	-	-	159	3.2
0073	South West WPCP	8	1397	-	3.0	143	2.5
0075	Orangeville WPCP	1	89	12	0.4	18	3.0
0076	Orillia WPCP	3	465	-	7.0	64	3.4
0077	Harmony Cr. WPCP	2	1765	15	3.7	-	3.0
0079	Green Creek WPCP	12	8052	8	32.0	1000	2.6
0082	Pembroke WPCP	4	1089	5	2.0	36	3.2
0083	Point Edward WPCP	1	90	-	-	5	3.2
0084	Port Hope WPCP	2	127	30	2.0	41	2.3
0085	Edwardsburg WPCP	2	180	24	1.6	16	2.5
0087	Sarnia WPCP	4	1505	6	10.0	45000	1.6

TABLE B-6. PRIMARY TREATMENT - CLARIFIERS

NO.	FACILITY NAME	NO. CLAR.	SUR. AREA (m^2)	PUMP FREQ. (#/d)	PUMP DUR. (hr/d)	PUMP RATE (m^3/d)	VS (%)
0088	Highland Creek Plant	12	8180	7	3.4	1000	2.5
0089	Simcoe WPCP	5	93	24	13.6	132	1.8
0091	Stratford WPCP	4	1870	24	4.0	51	2.1
0092	Sturgeon Falls WPCP	2	190	12	0.8	20	3.3
0093	Port Dalhousie WPCP	2	1330	24	2.4	286	-
0095	St. Thomas WPCP	6	1218	-	-	-	-
0097	Thunder Bay WPCP	6	3651	10	2.8	129	3.3
0098	Mattagami WPCP	2	1160	30	2.0	51	2.3
0102	Valley East WPCP	2	465	12	0.4	30	0.9
0103	Walkerton WPCP	3	287	247	1.2	25	1.8
0105	Waterloo WPCP	4	1642	110	4.0	232	2.7
0106	Welland WPCP	2	1115	2	4.0	123	-
0107	Pringle Creek WPCP 1	2	149	5	1.7	18	-
0111	Gimli Ind. Park WTP	2	-	-	-	-	-
0113	Northend WPCC	5	6524	6	13.5	1944	2.2
0114	North Battleford WWTP	2	420	4	2.0	135	-
0115	Regina WWTP	3	2100	12	1.5	147	1.6
0116	H. McIvor Wier WPCP	2	2307	22	4.0	376	1.9
0117	Fish Creek STP	4	1555	11	2.2	458	-
0118	Bonnybrook STP	12	489	1	24.0	700	4.0
0119	Gold Bar WWTP	8	6979	13	3.3	2596	2.1
0122	Red Deer WTP	3	1420	-	2.4	127	1.2
0125	Reg. Dist. Nanaimo	2	883	24	1.2	61	4.5
0126	Nelson City	2	170	2	1.0	-	-
0130	David S. Mackay Env. C.	3	520	24	3.5	-	-
0131	Skyway WPCP	4	3000	18	6.0	650	1.8
0132	Peterborough WPCP	4	1120	-	-	154	2.8

* only those plants with an active anaerobic digestion system have been included.

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TABLE B-7. BIOLOGICAL TREATMENT *

NO.	FACILITY NAME	AML SS (mg/L)	AML VSS (mg/L)	RAS SS (mg/L)	RAS FLOW (m^3/d)	WAS SS (mg/L)	WAS** FLOW (m^3/d)
0003	Wabush WTF	-	-	-	-	-	-
0005	Mill Cove WPCP	1750	1500	3500	9000	3500	73
0007	Lakeside Timberlea	0	0	0	0	0	0
0009	Oromocto	1500	-	-	-	-	-
0010	Usine D'Epuration	1440	955	4300	52000	4300	960
0013	Usine D'Epuration	1200	950	4000	1800	6000	30
0028	Barrie WPCP	2500	1700	9000	11000	9000	480
0029	Belleville WPCP	1970	1370	5730	21000	5730	1
0030	Brantford WPCP	2400	1680	9000	35000	9000	45
0031	Brockville WPCP	0	0	0	0	0	0
0032	Preston WPCP	2374	1784	3922	12778	3922	222
0033	Galt WPCP	1800	1350	3600	27276	3600	1274
0034	Cambellford WPCP	2400	1390	4000	2500	4000	1
0035	Chatham WPCP	2283	1484	6300	19	6300	-
0036	Cobourg WPCP #1	1671	1316	83	-	83	632
0037	Collingwood WPCP	3000	2100	8500	10500	8750	0
0038	Cornwall WPCP	0	0	0	0	0	0
0041	North Toronto Plant	2500	1750	6000	21600	6000	500
0043	Humber Plant	2029	1420	8405	163760	8405	4380
0044	Fergus WPCP	1897	978	5000	-	5000	12
0047	Fort Frances WPCP	0	0	0	0	0	0
0049	Guelph WPCP	2200	1742	-	19000	2200	950
0051	Georgetown WPCP	2140	1070	3200	8	3200	-
0052	Acton WPCP	2000	1443	3200	2720	200	280
0054	Hanover WPCP	1700	1315	-	-	-	-
0059	Kitchener WPCP	1750	1291	4500	55600	4500	-
0061	Midland WPCP	3500	1750	7000	8000	7000	300
0062	Milton WPCP	1550	1007	3468	11530	3468	563
0063	Lakeview WPCP	2500	1775	-	-	6000	7000
0064	Clarkson WPCP	2300	1600	9000	18000	9000	1100
0066	Napanee WPCP	2550	1245	7258	3900	7258	41
0067	Watts Creek WPCP	1399	995	3213	10102	3213	571
0068	Port Darlington	1600	1300	6000	20000	6000	366
0070	Stamford WPCP	0	0	0	0	0	0
0073	South West WPCP	1668	1168	4945	26000	4945	1000
0075	Orangeville WPCP	3000	1890	6000	7000	10000	200
0076	Orillia WPCP	1911	1389	10600	3000	10600	450
0077	Harmony Cr. WPCP	0	0	0	0	0	0
0079	Green Creek WPCP	0	0	0	0	0	0
0082	Pembroke WPCP	0	0	0	0	0	0
0083	Point Edward WPCP	0	0	0	0	0	0
0084	Port Hope WPCP	4179	2886	8342	-	9456	-
0085	Edwardsburg WPCP	0	0	0	0	0	0
0087	Sarnia WPCP	0	0	0	0	0	0

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TABLE B-7. BIOLOGICAL TREATMENT

NO.	FACILITY NAME	AML SS (mg/L)	AML VSS (mg/L)	RAS SS (mg/L)	RAS FLOW (m^3/d)	WAS SS (mg/L)	WAS** FLOW (m^3/d)
0088	Highland Creek	4500	3510	8000	100000	8000	7000
0089	Simcoe WPCP	3000	1503	-	7477	-	229
0091	Stratford WPCP	1600	1100	5350	11363	5350	247
0092	Sturgeon Falls WPCP	1500	800	5000	1818	5000	413
0093	Port Dalhousie WPCP	2610	1500	4353	43640	4353	930
0095	St. Thomas WPCP	2640	1716	5730	-	5730	-
0097	Thunder Bay WPCP	0	0	0	0	0	0
0098	Mattagami WPCP	0	0	0	0	0	0
0102	Valley East WPCP	1100	780	1960	5500	1960	-
0103	Walkerton WPCP	2700	2100	10430	1709	10430	36
0105	Waterloo WPCP	2299	1669	6428	16510	-	362
0106	Welland WPCP	2382	-	-	21620	-	677
0107	Pringle Creek WPCP	1750	1175	4500	3804	4500	346
0111	Gimli Ind. Park WTP	0	0	0	0	0	0
0113	Northend WPCC	4200	2800	16000	875	16000	2500
0114	North Battleford	-	-	-	-	-	-
0115	Regina WWTP	0	0	0	0	0	0
0116	H. McIvor Wier WPCP	0	0	0	0	0	0
0117	Fish Creek STP	4960	3522	16000	34530	23000	310
0118	Bonnybrook STP	1350	1500	6000	148	2000	7780
0119	Gold Bar WWTP	1500	1200	3200	24000	3200	8100
0122	Red Deer WTP	2200	1500	7100	15836	7100	708
0125	Nanaimo	0	0	0	0	0	0
0126	Nelson City	0	0	0	0	0	0
0130	David S. Mackay Env.	0	0	0	0	0	0
0131	Skyway WPCP	3100	2015	-	60222	-	1938
0132	Peterborough WPCP	2000	1400	4000	2800	4000	2800

* only those plants with an active anaerobic digestion system have been included.

** AML = average mixed liquor
RAS = return activated sludge
WAS = waste activated sludge

TABLE B-8. DIGESTER LOADING RATES *

NO.	FACILITY NAME	STG.1 HRT (d)	STG.1 VSLR (kg/ m³.d)	STG.1 CODLR (kg/ m³.d)	STG.2 HRT (d)	STG.2 VSLR (kg/ m³.d)	STG.2 CODLR (kg/ m³.d)
0003	Wabush WTF	-	-	-	-	-	-
0005	Mill Cove WPCP	13.0	-	-	13.0	-	-
0007	Lakeside Timberlea	-	0.40	-	-	-	-
0009	Oromocto	30.0	-	-	-	-	-
0010	Usine D'Epuration	15.0	2.40	-	15.0	-	-
0013	Usine D'Epuration	50.0	0.05	-	8.0	-	-
0028	Barrie WPCP	-	-	-	-	-	-
0029	Belleville WPCP	33.6	1.18	-	-	-	-
0030	Brantford WPCP	-	-	-	-	-	-
0031	Brockville WPCP	28.0	0.37	-	28.0	0.37	-
0032	Preston WPCP	24.8	-	-	-	-	-
0033	Galt WPCP	25.2	-	-	16.2	-	-
0034	Cambellford WPCP	54.0	-	-	-	-	-
0035	Chatham WPCP	-	-	-	-	-	-
0036	Cobourg WPCP #1	33.6	-	-	-	-	-
0037	Collingwood WPCP	21.0	-	-	21.0	-	-
0038	Cornwall WPCP	30.0	29.40	-	30.0	-	-
0041	North Toronto Plant	38.8	0.55	-	37.0	0.57	-
0043	Humber Plant	-	-	-	-	-	-
0044	Fergus WPCP	-	0.75	-	-	-	-
0047	Fort Frances WPCP	30.0	0.75	-	-	-	-
0049	Guelph WPCP	15.0	3.30	-	-	-	-
0051	Georgetown WPCP	32.2	0.85	-	7.4	-	-
0052	Acton WPCP	32.6	0.83	-	36.8	-	-
0054	Hanover WPCP	30.0	-	-	85.0	-	-
0059	Kitchener WPCP	-	1.84	-	-	0.10	-
0061	Midland WPCP	30.0	2.30	-	30.0	-	-
0062	Milton WPCP	26.9	1.58	-	16.9	-	-
0063	Lakeview WPCP	-	-	-	-	-	-
0064	Clarkson WPCP	21.2	-	-	-	-	-
0066	Napanee WPCP	28.0	-	-	-	-	-
0067	Watts Creek WPCP	14.7	1.59	-	14.7	-	-
0068	Port Darlington	21.1	-	-	90.3	-	-
0070	Stamford WPCP	-	2.25	-	15.5	-	-
0073	South West WPCP	18.0	1.17	-	18.0	1.17	-
0075	Orangeville WPCP	27.5	15.30	-	27.5	-	-
0076	Orillia WPCP	14.0	60.00	-	14.0	-	-
0077	Harmony Cr. WPCP	25.0	-	-	25.0	-	-
0079	Green Creek WPCP	19.7	1.13	-	14.8	-	-
0082	Pembroke WPCP	10.3	0.03	-	10.3	-	-
0083	Point Edward WPCP	-	10.91	-	-	-	-
0084	Port Hope WPCP	30.0	-	-	-	-	-
0085	Edwardsburg WPCP	-	0.87	-	-	-	-

TABLE B-8. DIGESTER LOADING RATES

NO.	FACILITY NAME	STG.1 HRT (d)	STG.1 VSLR (kg/ m^3.d)	STG.1 CODLR (kg/ m^3.d)	STG.2 HRT (d)	STG.2 VSLR (kg/ m^3.d)	STG.2 CODLR (kg/ m^3.d)
0087	Sarnia WPCP	-	-	-	-	-	-
0088	Highland Creek	30.0	1.40	-	-	-	-
0089	Simcoe WPCP	17.3	0.93	-	58.0	-	-
0091	Stratford WPCP	26.0	1.00	-	26.0	-	-
0092	Sturgeon Falls	30.0	-	-	-	-	-
0093	Port Dalhousie	22.0	-	-	10.0	-	-
0095	St. Thomas WPCP	-	-	-	-	-	-
0097	Thunder Bay WPCP	30.0	-	-	30.0	-	-
0098	Mattagami WPCP	-	-	-	-	-	-
0102	Valley East WPCP	40.0	-	-	-	-	-
0103	Walkerton WPCP	-	-	-	-	-	-
0105	Waterloo WPCP	20.0	1.28	-	20.0	0.61	-
0106	Welland WPCP	-	-	-	-	-	-
0107	Pringle Creek 1	40.0	20.00	-	-	-	-
0111	Gimli Ind. Park WTP	-	-	-	-	-	-
0113	Northend WPCC	10.0	1.76	-	10.0	2.50	-
0114	North Battleford	30.0	-	-	30.0	-	-
0115	Regina WWTP	28.0	1.60	-	14.0	-	-
0116	H. McIvor Wier WPCP	36.0	1.54	-	36.0	0.62	-
0117	Fish Creek STP	14.0	0.80	-	6.0	-	-
0118	Bonnybrook STP	34.0	1.00	-	-	-	-
0119	Gold Bar WWTP	17.0	1.30	-	-	-	-
0122	Red Deer WTP	13.3	2.30	-	4.4	-	-
0125	Nanaimo	40.0	2.96	-	40.0	2.96	-
0126	Nelson City	-	-	-	-	-	-
0130	David S. Mackay	15.0	-	-	-	-	-
0131	Skyway WPCP	12.0	1.50	-	40.0	-	-
0132	Peterborough WPCP	20.0	-	-	30.0	-	-

* only those plants with an active anaerobic digestion system have been included.

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TABLE B-9. DIGESTER INFLUENT & EFFLUENT PARAMETERS *

NO.	FACILITY NAME	PS LOAD (m^3/d)	WAS LOAD (m^3/d)	INF BOD (mg/L)	EFF BOD (mg/L)	INF SS (mg/L)	EFF SS (mg/L)
0003	Wabush WTF	-	-	-	-	-	-
0005	Mill Cove WPCP	41	-	160	20	130	15
0007	Lakeside Timberlea	16	-	247	5	182	19
0009	Oromocto	-	-	60	8	1000	-
0010	Usine D'Epuration	-	371	-	-	45000	29000
0013	Usine D'Epuration	21	30	-	-	-	-
0028	Barrie WPCP	150	-	260	5	210	5
0029	Belleville WPCP	96	-	160	30	102	12
0030	Brantford WPCP	241	45	170	12	220	10
0031	Brockville WPCP	39	-	85	20	134	20
0032	Preston WPCP	91	222	476	39	565	11
0033	Galt WPCP	137	1200	-	-	5200	2700
0034	Cambellford WPCP	9	1	-	-	-	-
0035	Chatham WPCP	124	-	162	7	230	21
0036	Cobourg WPCP #1	57	75	441	17	361	15
0037	Collingwood WPCP	39	42	-	-	-	-
0038	Cornwall WPCP	145	-	65	41	110	25
0041	North Toronto Plant	162	-	180	19	140	8
0043	Humber Plant	1580	290	230	9	300	15
0044	Fergus WPCP	9	12	-	-	-	-
0047	Fort Frances WPCP	15	-	55	35	100	60
0049	Guelph WPCP	180	950	-	-	-	-
0051	Georgetown WPCP	75	-	124	4	102	3
0052	Acton WPCP	39	-	171	2	147	5
0054	Hanover WPCP	28	-	150	8	200	8
0059	Kitchener WPCP	683	-	293	20	220	6
0061	Midland WPCP	35	-	70	5	150	5
0062	Milton WPCP	59	-	212	3	200	5
0063	Lakeview WPCP	1300	350	-	-	-	-
0064	Clarkson WPCP	225	-	250	16	280	12
0066	Napanee WPCP	62	-	-	-	-	-
0067	Watts Creek WPCP	125	-	77	10	129	8
0068	Port Darlington WPCP	30	366	-	-	-	-
0070	Stamford WPCP	159	-	-	-	-	-
0073	South West WPCP	143	-	250	12	235	12
0075	Orangeville WPCP	14	60	150	3	160	3
0076	Orillia WPCP	64	-	100	9	139	13
0077	Harmony Cr. WPCP	237	-	142	21	160	25
0079	Green Creek WPCP	1000	-	73	35	73	32
0082	Pembroke WPCP	36	-	55000	600	50000	500
0083	Point Edward WPCP	-	-	265	50	482	27
0084	Port Hope WPCP	41	-	53	6	69	6
0085	Edwardsburg WPCP	3500	-	-	-	-	-
0087	Sarnia WPCP	205	-	110	33	148	20

TABLE B-9. DIGESTER INFLUENT & EFFLUENT PARAMETERS

NO.	FACILITY NAME	PS LOAD (m^3/d)	WAS LOAD (m^3/d)	INF BOD (mg/L)	EFF BOD (mg/L)	INF SS (mg/L)	EFF SS (mg/L)
0088	Highland Creek Plant	-	30	180	10	200	15
0089	Simcoe WPCP	132	-	408	3	330	3
0091	Stratford WPCP	52	-	105	-	130	-
0092	Sturgeon Falls WPCP	20	-	-	-	-	-
0093	Port Dalhousie WPCP	-	452	-	-	39000	24000
0095	St. Thomas WPCP	77	-	-	-	-	-
0097	Thunder Bay WPCP	129	-	153	53	237	51
0098	Mattagami WPCP	51	-	53	23	164	40
0102	Valley East WPCP	27	-	138	11	147	4
0103	Walkerton WPCP	16	9	296	21	305	11
0105	Waterloo WPCP	-	-	250	8	350	12
0106	Welland WPCP	123	-	77	13	130	10
0107	Pringle Creek WPCP	36	-	-	-	29100	37900
0111	Gimli Ind. Park WTP	-	-	-	5	-	10
0113	Northend WPCC	2000	2500	-	-	-	-
0114	North Battleford	30	105	-	-	-	-
0115	Regina WWTP	147	-	210	148	255	127
0116	H. McIvor Wier WPCP	376	-	240	88	321	83
0117	Fish Creek STP	485	-	-	-	43000	20000
0118	Bonnybrook STP	700	900	163	7	154	10
0119	Gold Bar WWTP	2596	8100	-	211	32860	25542
0122	Red Deer WTP	110	120	-	-	-	-
0125	Nanaimo	61	-	199	89	34	55
0126	Nelson City	14	-	-	-	-	-
0130	David S. Mackay	-	-	-	-	-	-
0131	Skyway WPCP	650	1650	171	8	214	7
0132	Peterborough WPCP	154	-	-	-	4	3

* only those plants with an active anaerobic digestion system have been included.

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TABLE B-10. DIGESTER CONTENTS PARAMETERS *

NO.	FACILITY NAME	TS (%)	VS (%)	VA (mg/L)	ALK (mg/L)	pH
0003	Wabush WTF	-	-	-	-	6.8
0005	Mill Cove WPCP	3.5	3.0	288	2400	6.9
0007	Lakeside Timberlea	3.3	2.3	206	1460	6.8
0009	Oromocto	-	-	-	-	7.0
0010	Usine D'Epuration	3.3	1.7	410	2930	7.5
0013	Usine D'Epuration	2.0	1.0	100	3000	7.1
0028	Barrie WPCP	3.6	1.8	600	3000	7.2
0029	Belleville WPCP	2.2	1.2	138	3720	6.9
0030	Brantford WPCP	4.3	3.2	512	2700	7.2
0031	Brockville WPCP	3.0	1.4	148	2000	7.0
0032	Preston WPCP	2.3	1.2	32	5650	7.7
0033	Galt WPCP	3.0	1.6	450	2000	6.8
0034	Cambellford WPCP	5.5	2.2	-	2500	7.3
0035	Chatham WPCP	3.2	1.6	411	1904	7.2
0036	Cobourg WPCP #1	1.0	0.7	56	-	6.9
0038	Cornwall WPCP	3.5	1.7	192	1667	7.0
0041	North Toronto Plant	5.9	3.0	-	-	-
0043	Humber Plant	2.3	1.4	300	3000	7.3
0044	Fergus WPCP	5.6	3.2	-	-	7.6
0047	Fort Frances WPCP	5.0	2.8	700	-	6.8
0049	Guelph WPCP	2.6	1.6	300	2800	7.1
0051	Georgetown WPCP	2.2	1.0	105	3398	7.2
0052	Acton WPCP	2.2	1.3	394	3662	7.4
0054	Hanover WPCP	-	-	-	-	-
0059	Kitchener WPCP	2.9	1.6	45	4000	7.1
0061	Midland WPCP	4.0	1.4	250	2300	7.6
0062	Milton WPCP	6.0	4.2	350	2250	7.0
0063	Lakeview WPCP	-	-	-	-	-
0064	Clarkson WPCP	4.3	2.2	600	4900	7.8
0066	Napanee WPCP	1.3	0.7	-	-	7.0
0067	Watts Creek WPCP	2.8	1.5	109	3725	7.3
0068	Port Darlington WPCP	2.2	1.1	45	2800	7.4
0070	Stamford WPCP	-	-	-	-	-
0073	South West WPCP	3.9	2.6	500	3000	7.0
0075	Orangeville WPCP	3.5	2.1	-	-	6.9
0076	Orillia WPCP	3.7	2.4	-	-	7.1
0077	Harmony Cr. WPCP	5.0	3.1	-	-	-
0079	Green Creek WPCP	2.0	1.0	100	2150	7.1
0082	Pembroke WPCP	3.5	1.8	1750	-	6.8
0083	Point Edward WPCP	-	-	-	1940	7.4
0084	Port Hope WPCP	4.3	2.2	-	-	7.6
0085	Edwardsburg WPCP	-	-	-	-	-
0087	Sarnia WPCP	8.0	3.4	-	-	7.0
0088	Highland Creek Plant	3.0	1.7	175	-	7.2
0089	Simcoe WPCP	2.8	1.1	-	3243	7.6

TABLE B-10. DIGESTER CONTENTS PARAMETERS

NO.	FACILITY NAME	TS (%)	VS (%)	VA (mg/L)	ALK (mg/L)	pH
0091	Stratford WPCP	6.0	3.7	210	4400	7.5
0092	Sturgeon Falls WPCP	3.0	1.2	500	-	7.2
0093	Port Dalhousie WPCP	3.5	1.3	343	2350	6.8
0095	St. Thomas WPCP	-	-	-	-	-
0097	Thunder Bay WPCP	6.9	3.2	120	4664	7.1
0098	Mattagami WPCP	5.3	2.8	37	2109	6.9
0102	Valley East WPCP	2.4	1.1	30	2600	7.2
0103	Walkerton WPCP	2.2	1.4	140	5080	7.4
0105	Waterloo WPCP	3.0	1.7	-	-	7.1
0106	Welland WPCP	-	-	-	-	-
0107	Pringle Creek 1	3.0	1.9	300	2500	7.0
0111	Gimli Ind. Park WTP	-	-	-	-	-
0113	Northend WPCC	3.7	1.6	90	4000	7.4
0114	North Battleford	6.0	-	-	-	7.2
0115	Regina WWTP	1.9	0.9	300	2250	7.0
0116	H. McIvor Wier WPCP	4.4	2.0	180	2219	7.2
0117	Fish Creek STP	-	-	300	3590	7.2
0118	Bonnybrook STP	2.3	1.3	360	4200	7.4
0119	Gold Bar WWTP	2.6	1.3	190	2700	-
0122	Red Deer WTP	-	-	-	-	-
0125	Nanaimo	3.3	2.4	200	2600	7.1
0126	Nelson City	1.5	-	140	1500	7.3
0130	David S. Mackay	1.0	0.5	130	2300	7.0
0131	Skyway WPCP	3.9	1.8	296	2500	7.0
0132	Peterborough WPCP	2.5	1.5	750	3200	7.2

* only those plants with an active anaerobic digestion system have been included.

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TABLE B-11. DIGESTER CONSTRUCTION MATERIALS - STAGE 1 *

NO.	FACILITY NAME	MATERIAL	INSUL. TYPE	INSUL. THICK. (cm)	TEMP. (C)d
0003	Wabush WTF	concrete	none	0.00	34
0005	Mill Cove WPCP	concrete	none	0.00	35
0007	Lakeside Timberlea	brick concrete	styrofoam	2.54	35
0009	Oromocto	concrete steel	styrofoam	5.00	35
0010	Usine D'Epuration	concrete	earth	0.00	34
0013	Usine D'Epuration	concrete	none	0.00	21
0028	Barrie WPCP	concrete brick	none	0.00	35
0029	Belleville WPCP	concrete	none	0.00	34
0030	Brantford WPCP	concrete	foam	7.62	35
0031	Brockville WPCP	concrete brick	none	0.00	35
0032	Preston WPCP	concrete steel	none	0.00	37
0033	Galt WPCP	concrete fiber.	none	0.00	34
0034	Cambellford WPCP	concrete	none	0.00	33
0035	Chatham WPCP	concrete	none	0.00	35
0036	Cobourg WPCP #1	concrete	none	0.00	34
0037	Collingwood WPCP	concrete steel	styrofoam	5.00	35
0038	Cornwall WPCP	concrete brick	styrofoam	5.00	37
0041	North Toronto Plant	concrete	none	0.00	34
0043	Humber Plant	concrete	earth	0.00	35
0044	Fergus WPCP	concrete	styrofoam	5.00	27
0047	Fort Frances WPCP	concrete brick	styrofoam	5.00	35
0049	Guelph WPCP	concrete brick	styrofoam	5.00	36
0051	Georgetown WPCP	con. br. st.	none	0.00	33
0052	Acton WPCP	concrete	earth	0.00	35
0054	Hanover WPCP	concrete	styrofoam	5.00	35
0059	Kitchener WPCP	concrete steel	unknown	7.62	35
0061	Midland WPCP	concrete	styrofoam	5.08	36
0062	Milton WPCP	concrete fiber.	none	0.00	36
0063	Lakeview WPCP	unknown	none	0.00	36
0064	Clarkson WPCP	concrete	styrofoam	7.62	-
0066	Napanee WPCP	concrete brick	polyurethane	7.62	35
0067	Watts Creek WPCP	concrete brick	none	0.00	35
0068	Port Darlington WPCP	concrete	foam	-	35
0070	Stamford WPCP	unknown	styrofoam	7.62	35
0073	South West WPCP	concrete brick	styrofoam	5.08	35
0075	Orangeville WPCP	concrete marble	styrofoam	5.08	33
0076	Orillia WPCP	concrete steel	foam	12.00	35
0077	Harmony Cr. WPCP	concrete	none	0.00	37
0079	Green Creek WPCP	concrete	earth	0.00	35
0082	Pembroke WPCP	concrete	none	0.00	35
0083	Point Edward WPCP	concrete steel	unknown	-	32
0084	Port Hope WPCP	concrete	foamglass	5.00	34
0085	Edwardsburg WPCP	unknown	earth foam	5.08	-
0087	Sarnia WPCP	concrete	none	0.00	35

TABLE B-11. DIGESTER CONSTRUCTION MATERIALS - STAGE 1

NO.	FACILITY NAME	MATERIAL	INSUL. TYPE	INSUL. THICK (cm)	TEMP. (C)
0088	Highland Creek Plant	concrete steel	none	0.00	36
0089	Simcoe WPCP	concrete steel	none	0.00	38
0091	Stratford WPCP	concrete	unknown	5.00	34
0092	Sturgeon Falls WPCP	concrete	unknown	6.35	35
0093	Port Dalhouise WPCP	concrete	styrofoam	3.80	35
0095	St. Thomas WPCP	unknown	unknown	-	-
0097	Thunder Bay WPCP	concrete	fiberglass	4.50	35
0098	Mattagami WPCP	concrete	fibre	3.80	35
0102	Valley East WPCP	concrete	none	0.00	35
0103	Walkerton WPCP	concrete steel	foam glass	5.00	35
0105	Waterloo WPCP	unknown	polyurethane	5.08	35
0106	Welland WPCP	concrete steel	unknown	1.57	35
0107	Pringle Creek 1	concrete brick	foam glass	4.50	37
0111	Gimli Ind. Park WTP	concrete	none	0.00	35
0113	Northend WPCC	concrete	polystrene	5.00	37
0114	North Battleford	concrete	earth	0.00	35
0115	Regina WWTP	concrete	earth rig.	8.50	35
0116	H. McIvor Wier WPCP	concrete	styrofoam	14.00	36
0117	Fish Creek STP	concrete brick	fibreglass	5.00	35
0118	Bonnybrook STP	concrete brick	fibreglass	5.00	35
0119	Gold Bar WWTP	concrete brick	styrofoam	-	37
0122	Red Deer WTP	concrete block	unknown	-	35
0125	Nanaimo	concrete	styrofoam	2.54	35
0126	Nelson City	concrete steel	none	0.00	35
0130	David S. Mackay	concrete	unknown	5.08	38
0131	Skyway WPCP	concrete	styrofoam	5.08	33
0132	Peterborough WPCP	concrete	earth	0.00	35

* only those plants with an active anaerobic digestion system have been inluded.

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TABLE B-12. DIGESTER CONSTRUCTION MATERIALS - STAGE 2 *

NO.	FACILITY NAME	MATERIAL	INSUL. TYPE	INSUL. THICK. (cm)	TEMP. (C)
0003	Wabush WTF	-	-	-	-
0005	Mill Cove WPCP	concrete	none	0.00	21
0007	Lakeside Timberlea	-	-	-	-
0009	Oromocto	-	-	-	-
0010	Usine D'Epuration	concrete	earth	0.00	-
0013	Usine D'Epuration	concrete	none	0.00	-
0028	Barrie WPCP	concrete brick	none	0.00	-
0029	Belleville WPCP	concrete	none	0.00	-
0030	Brantford WPCP	concrete	foam	7.62	-
0031	Brockville WPCP	concrete brick	none	0.00	29
0032	Preston WPCP	concrete steel	none	0.00	-
0033	Galt WPCP	concrete steel	none	0.00	-
0034	Cambellford WPCP	-	-	-	-
0035	Chatham WPCP	concrete	none	0.00	-
0036	Cobourg WPCP #1	concrete	none	0.00	-
0037	Collingwood WPCP	concrete steel	styrofoam	5.00	20
0038	Cornwall WPCP	concrete brick	styrofoam	5.00	-
0041	North Toronto Plant	concrete	none	0.00	-
0043	Humber Plant	concrete	earth	0.00	-
0044	Fergus WPCP	-	-	-	-
0047	Fort Frances WPCP	-	-	-	-
0049	Guelph WPCP	-	-	-	-
0051	Georgetown WPCP	con. br. st.	none	0.00	-
0052	Acton WPCP	concrete	none	0.00	-
0054	Hanover WPCP	concrete	styrofoam	5.00	-
0059	Kitchener WPCP	concrete steel	earth ins.	7.62	-
0061	Midland WPCP	concrete	styrofoam	5.08	-
0062	Milton WPCP	con. fiber.	none	0.00	-
0063	Lakeview WPCP	unknown	none	0.00	-
0064	Clarkson WPCP	concrete	styrofoam	7.62	-
0066	Napanee WPCP	-	-	-	-
0067	Watts Creek WPCP	concrete brick	none	0.00	-
0068	Port Darlington WPCP	concrete	foam	0.00	-
0070	Stamford WPCP	unknown	styrofoam	7.62	-
0073	South West WPCP	concrete brick	styrofoam	5.08	-
0075	Orangeville WPCP	concrete marble	styrofoam	5.08	20
0076	Orillia WPCP	concrete steel	foam	12.00	-
0077	Harmony Cr. WPCP	wood steel	none	0.00	-
0079	Green Creek WPCP	concrete	none	0.00	-
0082	Pembroke WPCP	concrete	none	0.00	-
0083	Point Edward WPCP	-	-	-	-
0084	Port Hope WPCP	-	-	-	-
0085	Edwardsburg WPCP	-	-	-	-
0087	Sarnia WPCP	concrete	none	0.00	-

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TABLE B-12. DIGESTER CONSTRUCTION MATERIALS - STAGE 2

NO.	FACILITY NAME	MATERIAL	INSUL. TYPE	INSUL. THICK. (cm)	TEMP. (C)
0088	Highland Creek Plant	concrete steel	none	0.00	-
0089	Simcoe WPCP	concrete steel	none	0.00	-
0091	Stratford WPCP	concrete	unknown	5.00	-
0092	Sturgeon Falls WPCP	-	-	-	-
0093	Port Dalhousie WPCP	concrete	styrofoam	3.80	-
0095	St. Thomas WPCP	-	-	-	-
0097	Thunder Bay WPCP	concrete	fiberglass	4.50	28
0098	Mattagami WPCP	concrete	fibre	3.80	-
0102	Valley East WPCP	concrete	none	0.00	-
0103	Walkerton WPCP	concrete steel	foam glass	5.00	-
0105	Waterloo WPCP	unknown	polyurethane	5.08	-
0106	Welland WPCP	concrete steel	unknown	1.57	-
0107	Pringle Creek 1	concrete brick	foam glass	4.50	-
0111	Gimli nd. Park WTP	-	-	-	-
0113	Northend WPCC	concrete	polystrene	5.00	-
0114	North Battleford	concrete	earth	0.00	35
0115	Regina WWTP	concrete	earth rig.	8.50	30
0116	H. McIvor Wier WPCP	concrete	styrofoam	14.00	34
0117	Fish Creek STP	concrete brick	fibreglass	5.00	-
0118	Bonnybrook STP	concrete brick	fibreglass	5.00	-
0119	Gold Bar WWTP	concrete brick	styrofoam	-	-
0122	Red Deer WTP	concrete block	unknown	-	-
0125	Nanaimo	concrete	styrofoam	2.54	29
0126	Nelson City	concrete steel	none	0.00	-
0130	David S. Mackay	-	-	-	-
0131	Skyway WPCP	concrete	styrofoam	5.08	-
0132	Peterborough WPCP	concrete	foam rigid	5.00	33

* only those plants with an active anaerobic digestion system have been included.

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TABLE B-13. DIGESTER HEATING AND MIXING SYSTEMS *

NO.	FACILITY NAME	HEATING SYSTEM	RECIR. RATE (m^3/h)	WASTE HEAT (GJ/d)	HEAT LOSS (GJ/d)	MIXING SYSTEM	MIXING ENERGY (kW)
0003	Wabush WTF	hot water - sludge recirc	-	-	-	none	-
0005	Mill Cove WPCP	hot water - sludge recirc	41	-	-	gas	4
0007	Lakeside Timberlea STP	hot water - sludge recirc	41	-	-	none	-
0009	Oromocto	hot water - sludge recirc	-	-	-	gas	-
0010	Usine D'Epuration Regional	hot water - sludge recirc	-	17.00	-	mechanical	34
0013	Usine D'Epuration	hot water	-	-	-	mechanical	5
0028	Barrie WPCP	hot water - sludge recirc	-	-	-	gas	-
0029	Belleville WPCP	hot water - sludge recirc	-	-	-	gas - sludge recirc	-
0030	Brantford WPCP	hot water - sludge recirc	-	-	-	gas	22
0031	Brockville WPCP	hot water - sludge recirc	41	-	-	gas	-
0032	Preston WPCP	hot water - sludge recirc	46	-	-	gas	-

TABLE B-13. DIGESTER HEATING AND MIXING SYSTEMS

NO.	FACILITY NAME	HEATING SYSTEM	RECIR. RATE (m^3/h)	WASTE HEAT (GJ/d)	HEAT LOSS (GJ/d)	MIXING SYSTEM	MIXING ENERGY (kW)
0033	Galt WPCP	hot water	57	-	-	gas	13
0034	Cambellford WPCP	hot water	785	-	-	gas	-
0035	Chatham WPCP	hot water	41	-	-	gas	8
0036	Cobourg WPCP #1	hot water - sludge recirc	79	-	-	gas	6
0037	Collingwood WPCP	hot water - sludge recirc	45	-	-	gas	-
0038	Cornwall WPCP	hot water - sludge recirc	250	-	-	gas	6
0041	North Toronto Plant	hot water - sludge recirc	-	-	-	sludge recirc	-
0043	Humber Plant	hot water - sludge recirc	180	-	-	gas - mechanical	-
0044	Fergus WPCP	hot water - sludge recirc	41	-	-	mechanical	6
0047	Fort Frances WPCP	hot water - sludge recirc	27	-	-	gas	8
0049	Guelph WPCP	hot water - sludge recirc	218	-	-	gas - sludge recirc	-
0051	Georgetown WPCP	hot water - sludge recirc	34	-	-	gas	-
0052	Acton WPCP	hot water - sludge recirc	-	-	-	mechanical	-

TABLE B-13. DIGESTER HEATING AND MIXING SYSTEMS

NO.	FACILITY NAME	HEATING SYSTEM	RECIR. RATE (m^3/h)	WASTE HEAT (GJ/d)	HEAT LOSS (GJ/d)	MIXING SYSTEM	MIXING ENERGY (kW)
0054	Hanover WPCP	hot water - sludge recirc	40	-	-	gas - sludge recirc	11
0059	Kitchener WPCP	hot water	-	-	-	gas	9
0061	Midland WPCP	hot water - sludge recirc	-	-	-	mechanical	4
0062	Milton WPCP	hot water - sludge recirc	34	0.19	-	gas	
0063	Lakeview WPCP	none	-	-	-	none	-
0064	Clarkson WPCP	hot water - sludge recirc	-	-	-	gas	-
0066	Napanee WPCP	hot water - sludge recirc	-	-	-	gas	-
0067	Watts Creek WPCP	hot water - sludge recirc	85	0.01	0.01	gas - sludge recirc	-
0068	Port Darlington WPCP	hot water - sludge recirc	34	-	-	gas	5
0070	Stamford WPCP	hot water - sludge recirc	-	-	-	gas	-
0073	South West WPCP	hot water - sludge recirc	51	-	-	gas	-
0075	Orangeville WPCP	hot water - sludge recirc	-	-	-	gas - sludge recirc	13

TABLE B-13. DIGESTER HEATING AND MIXING SYSTEMS

NO.	FACILITY NAME	HEATING SYSTEM	RECIR. RATE (m^3/h)	WASTE HEAT (GJ/d)	HEAT LOSS (GJ/d)	MIXING SYSTEM	MIXING ENERGY (kW)
0076	Orillia WPCP	hot water - sludge recirc	32	-	-	gas	11
0077	Harmony Cr. WPCP	hot water - sludge recirc	109	-	-	mechanical	17
0079	Green Creek WPCP	hot water - sludge recirc	180	0.20	0.50	gas	75
0082	Pembroke WPCP	hot water - sludge recirc	38	-	-	gas - sludge recirc	-
0083	Point Edward WPCP	hot water - sludge recirc	-	-	-	mechanical	2
0084	Port Hope WPCP	hot water - sludge recirc	41	-	-	sludge recirc	2
0085	Edwardsburg WPCP	hot water	-	-	-	gas	-
0087	Sarnia WPCP	hot water	-	-	-	sludge recirc	-
0088	Highland Creek Plant	hot water - sludge recirc	-	-	-	mechanical	17
0089	Simcoe WPCP	hot water - sludge recirc	55	-	-	mechanical	11
0091	Stratford WPCP	hot water - sludge recirc	-	-	-	gas	-
0092	Sturgeon Falls WPCP	hot water - sludge recirc	82	-	-	gas	-

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TABLE B-13. DIGESTER HEATING AND MIXING SYSTEMS

NO.	FACILITY NAME	HEATING SYSTEM	RECIR. RATE (m^3/h)	WASTE HEAT (GJ/d)	HEAT LOSS (GJ/d)	MIXING SYSTEM	MIXING ENERGY (kW)
0093	Port Dalhousie WPCP	hot water - sludge recirc	-	-	-	gas	-
0095	St. Thomas WPCP	unknown	-	-	-	unknown	-
0097	Thunder Bay WPCP	hot water - sludge recirc	68	-	-	gas	41
0098	Mattagami WPCP	unknown	-	-	-	gas	-
0102	Valley East WPCP	hot water - sludge recirc	34	-	-	gas - sludge recirc	-
0103	Walkerton WPCP	hot water - sludge recirc	41	-	-	gas	8
0105	Waterloo WPCP	hot water - sludge recirc	-	-	-	gas - mechanical	-
0106	Welland WPCP	hot water - sludge recirc	68	-	-	gas	-
0107	Pringle Creek WPCP No. 1	hot water - sludge recirc	-	-	-	sludge recirc	10
0111	Gimli Ind. Park WTP	hot water - pipe coil	-	-	-	mechanical	-
0113	Northend WPCC	hot water - sludge recirc	176	-	-	gas	1060
0114	North Battleford WWTP	hot water - sludge recirc	27	-	-	gas	-

TABLE B-13. DIGESTER HEATING AND MIXING SYSTEMS

NO.	FACILITY NAME	HEATING SYSTEM	RECIR. RATE (m^3/h)	WASTE HEAT (GJ/d)	HEAT LOSS (GJ/d)	MIXING SYSTEM	MIXING ENERGY (kW)
0115	Regina WWTP	hot water - sludge recirc	137	25.00	-	mechanical	30
0116	H. McIvor Wier WPCP	hot water - sludge recirc	87	-	-	gas	50
0117	Fish Creek STP	hot water - sludge recirc	-	-	-	gas	-
0118	Bonnybrook STP	hot water - sludge recirc	-	-	-	gas	470
0119	Gold Bar WWTP	hot water - sludge recirc	-	-	-	gas - sludge recirc	-
0122	Red Deer WTP	glycol (steam)- sludge recirc	-	-	-	sludge recirc	-d
0125	Regional District of Nanaimo	hot water - sludge recirc	23	-	-	gas - sludge recirc	-
0126	Nelson City	hot water - sludge recirc	-	-	-	sludge recirc	-
0130	David S. Mackay Env. Centre	unknown	-	-	-	gas	-
0131	Skyway WPCP	hot water - sludge recirc	-	-	-	gas	-
0132	Peterborough WPCP	hot water - sludge recirc	-	-	-	gas	8

* only those plants with an active anaerobic digestion system have been included.

TABLE B-14. BIOGAS PRODUCTION *

NO.	FACILITY NAME	BIOGAS PROD. (m^3/d)	BIOGAS QUAL. (% CH_4)	INT. STO. (m^3)	INT. PR. (kPa)	EXT. STO. (m^3)	EXT. PR. (kPa)
0003	Wabush WTF	-	-	-	-	-	-
0005	Mill Cove WPCP	736	70	227	2.24	0	0
0007	Lakeside Timberlea	263	68	212	2.37	0	0
0009	Oromocto	220	-	15	-	-	2
0010	Usine D'Epuration	4400	62	1650	1.50	35400	1050
0013	Usine D'Epuration	-	-	-	-	-	-
0028	Barrie WPCP	3500	-	700	2.40	0	0
0029	Belleville WPCP	1348	-	-	7.50	0	0
0030	Brantford WPCP	6000	-	6468	3.00	0	0
0031	Brockville WPCP	980	-	214	13.00	0	0
0032	Preston WPCP	-	-	-	2.90	0	0
0033	Galt WPCP	1800	68	2292	2.50	0	0
0034	Cambellford WPCP	-	-	3	-	0	0
0035	Chatham WPCP	1244	-	-	3.50	0	0
0036	Cobourg WPCP #1	1206	-	54	2.70	0	0
0037	Collingwood WPCP	240	-	212	3.00	0	0
0038	Cornwall WPCP	1623	80	23	3.00	0	0
0041	North Toronto Plant	2400	-	-	3.24	0	0
0043	Humber Plant	26830	68	-	-	0	0
0044	Fergus WPCP	-	-	-	-	0	0
0047	Fort Frances WPCP	320	-	-	-	-	-
0049	Guelph WPCP	3000	-	9	68.90	0	0
0051	Georgetown WPCP	850	68	290	3.00	43	3
0052	Acton WPCP	-	65	-	-	-	-
0054	Hanover WPCP	-	-	200	2.10	0	0
0059	Kitchener WPCP	-	70	80570	2.74	0	0
0061	Midland WPCP	400	-	-	3.24	0	0
0062	Milton WPCP	-	61	0	0.00	0	0
0063	Lakeview WPCP	10000	66	-	-	-	-
0064	Clarkson WPCP	6000	-	737	-	0	0
0066	Napanee WPCP	268	-	-	-	0	0
0067	Watts Creek WPCP	1700	55	439	3.63	0	0
0068	Port Darlington WPCP	525	-	-	2.74	515	306
0070	Stamford WPCP	2550	-	-	-	-	-
0073	South West WPCP	2956	-	-	14.00	0	0
0075	Orangeville WPCP	200	65	-	77.00	60	225
0076	Orillia WPCP	849	73	9100	3.00	0	0
0077	Harmony Cr. WPCP	1120	60	0	0.00	0	0
0079	Green Creek WPCP	17717	63	650	103.8	4200	187
0082	Pembroke WPCP	200	65	350	3.00	0	0
0083	Point Edward WPCP	-	-	-	-	-	-
0084	Port Hope WPCP	156	70	90	3.98	0	0
0085	Edwardsburg WPCP	130	-	-	-	-	-
0087	Sarnia WPCP	2100	64	799	-	0	0

TABLE B-14. BIOGAS PRODUCTION

NO.	FACILITY NAME	BIOGAS PROD. (m^3/d)	BIOGAS QUAL. (% CH_4)	INT. STO. (m^3)	INT. PR. (kPa)	EXT. STO. (m^3)	EXT. PR. (kPa)
0088	Highland Creek Plant	9500	65	4000	2.74	0	0
0089	Simcoe WPCP	-	68	-	1.99	0	0
0091	Stratford WPCP	-	65	208	2.50	0	0
0092	Sturgeon Falls WPCP	191	60	-	10.00	0	0
0093	Port Dalhousie WPCP	2795	-	683	2.30	0	0
0095	St. Thomas WPCP	-	-	-	-	-	-
0097	Thunder Bay WPCP	2214	70	28	3.00	0	0
0098	Mattagami WPCP	785	-	281	3.00	0	0
0102	Valley East WPCP	-	-	340	2.49	0	0
0103	Walkerton WPCP	-	-	163	9.49	0	0
0105	Waterloo WPCP	659	-	-	3.92	0	0
0106	Welland WPCP	188	-	-	-	-	-
0107	Pringle Creek 1	-	-	73	-	0	0
0111	Gimli Ind. Park WTP	-	-	-	-	-	-
0113	Northend WPCC	30000	62	5200	2.25	6400	138
0114	North Battleford	500	80	10	-	0	0
0115	Regina WWTP	4800	65	320	3.50	0	0
0116	H. McIvor Wier WPCP	6485	63	445	3.50	0	0
0117	Fish Creek STP	7289	65	1120	4.00	0	0
0118	Bonnybrook STP	26751	65	13249	0.57	5600	1380
0119	Gold Bar WWTP	33110	63	5000	3.50	0	0
0122	Red Deer WTP	5000	55	0	0.00	0	0
0125	Nanaimo	1300	65	10	690.0	55	690
0126	Nelson City	-	-	-	-	-	-
0130	David S. Mackay	-	75	-	93.00	0	0
0131	Skyway WPCP	4800	-	0	0.00	-	170
0132	Peterborough WPCP	2550	70	-	2.10	0	0

* only those plants with an active anaerobic digestion system have been included.d

TABLE B-15. BOILER MANUFACTURES *

NO.	FACILITY NAME	SIZE (BTU)	TYPE	MANUFACTURING
0003	Wabush WTF	-	-	-
0005	Mill Cove WPCP	750000	PFT	Pacific Flush Tank
0007	Lakeside Timberlea STP	-	hot water fire tube	Volanco
0009	Oromocto	750000	PFT fire tube	Pacific Flush Tank
0010	Usine D'Epuration Regional	-	TJH-C10 (2), TJH-C12.5 (1)	Volcano
0013	Usine D'Epuration	-	-	-
0028	Barrie WPCP	1950000	-	Pacific Flush Tank Walker Process
0029	Belleville WPCP	6000000	water tube fire tube	Cleaver Brooks
0030	Brantford WPCP	12384000	tube marine type	Dominion Bridge Martin Oakwood
0031	Brockville WPCP	750000	-	Pacific Flush Tank
0032	Preston WPCP	1032000	lopact	Ray Burner
0033	Galt WPCP	1600000	M4W-2000 Series 200	Cleaver Brooks
0034	Cambellford WPCP	670000	hot water	Cleaver Brooks
0035	Chatham WPCP	2064000	hot water, tube type	Waterloo Manufacturing
0036	Cobourg WPCP #1	1125000	PFT 1126	Pacific Flush Tank
0037	Collingwood WPCP	800000	Lopact fire tube	Ray Burner Martin Oakwood
0038	Cornwall WPCP	1376000	steam	Cleaver Brooks

TABLE B-15. BOILER MANUFACTURES

NO.	FACILITY NAME	SIZE (BTU)	TYPE	MANUFACTURING
0041	North Toronto Plant	4816000	fire tube	E. Leonard & Sons
0043	Humber Plant	-	drum	Dominion Bridge
0044	Fergus WPCP	-	PFT fire tube	Pacific Flush Tank
0047	Fort Frances WPCP	-	-	-
0049	Guelph WPCP	5126000	hot water	Cleaver Brooks Pacific Flush
0051	Georgetown WPCP	1600000	hot water tube	Cleaver Brooks
0052	Acton WPCP	-	Petco W.T.	Pacific Flush Tank
0054	Hanover WPCP	550000	hot water bath	Pacific Flush Tank
0059	Kitchener WPCP	-	water tube	Cleaver Brooks
0061	Midland WPCP	516000	HRT fire tube	Cleaver Brooks
0062	Milton WPCP	-	-	-
0063	Lakeview WPCP	-	-	-
0064	Clarkson WPCP	10320000	packaged coiled tube units	Canadian Boilers
0066	Napanee WPCP	208700	Model R300B	Hydro therm
0067	Watts Creek WPCP	1720000	low pressure	Ray Burner
0068	Port Darlington1 WPCP	376000	Dual P	Volcano
0070	Stamford WPCP	125000		
0073	South West WPCP	-	hot water	York Shipley Napanee
0075	Orangeville WPCP	900000	flexible tube	Bryan

TABLE B-15. BOILER MANUFACTURES

NO.	FACILITY NAME	SIZE (BTU)	TYPE	MANUFACTURING
0076	Orillia WPCP	2100000	low pressure hot water	Ray Burner Martin Oakwood
0077	Harmony Cr. WPCP	1470000	tube	Ray Burner
0079	Green Creek WPCP	-	high pressure	Dominion Bridge
0082	Pembroke WPCP	1340000	hot water	Napanee
0083	Point Edward WPCP	-	-	-
0084	Port Hope WPCP	-	Nat.l PD4	Pacific Flush Tank
0085	Edwardsburg WPCP	125000	-	-
0087	Sarnia WPCP	1660000	-	-
0088	Highland Creek Plant	247000	packaged fire tube	Ray Burner
0089	Simcoe WPCP	2752000	fire tube	Ray Burner
0091	Stratford WPCP	860000	low pressure	York Shipley
0092	Sturgeon Falls WPCP	584000	-	Walker Process
0093	Port Dalhousie WPCP	4300000	low pressure hot water	Cleaver Brooks
0095	St. Thomas WPCP	-	-	-
0097	Thunder Bay WPCP	5492000	hot water	Cleaver Brooks Volcano
0098	Mattagami WPCP	1000000	water tube	Cleaver Brooks
0102	Valley East WPCP	560000	fire tube	Pacific Flush Tube
0103	Walkerton WPCP	560000	hot water	Pacific Flush Tank

TABLE B-15. BOILER MANUFACTURES

NO.	FACILITY NAME	SIZE (BTU)	TYPE	MANUFACTURING
0105	Waterloo WPCP	5297600	fire tube	Dominion Bridge Cleaver Brooks
0106	Welland WPCP	3347000	flame tube type	Cleaver Brooks
0107	Pringle Creek WPC No. 1	-	fire box	Pacific Flush Tube
0111	Gimli Ind. Park WTP	-	-	-
0113	Northend WPCC	-	hot water fire tube	Dominion Bridge Cleaver Brooks
0114	North Battleford WWTP	-	-	-
0115	Regina WWTP	6000000	water tube	Cleaver Brooks
0116	H. McIvor Wier WPCP	5160000	low pressure steam	Saskatoon Boiler
0117	Fish Creek STP	24080000	fire tube	Cleaver Brooks
0118	Bonnybrook STP	2363586	fire tube	Volcano Cleaver Brooks
0119	Gold Bar WWTP	37840000	fire tube	Cleaver Brooks
0122	Red Deer WTP	-	-	Cleaver Brooks
0125	Regional District of Nanaimo	722400	water tube	Bryan Steam
0126	Nelson City	316000	hot water	Raypak
0130	David S. Mackay Env. Centre	-	CL90W-SG	Bryan
0131	Skyway WPCP	-	York 5M boiler CLH	York Shipley
0132	Peterborough WPCP	1250000	hot water	Pacific Flush

* only those plants with an active anaerobic digestion system have been included.d

TABLE B-16. ALTERNATIVE BOILER FUEL CONSUMPTION *

NO.	FACILITY NAME	FUELS	CONS. (m^3/y)	COST ($/y)	USE
0003	Wabush WTF	-	-	-	-
0005	Mill Cove WPCP	furnace fuel	7	3000	
0007	Lakeside Timberlea STP	propane	61	15812	digesters buildings
0009	Oromocto	fuel oil	45	8860	digesters buildings
0010	Usine D'Epuration Regional	no. 2 oil, natural gas	161000	122000	digesters buildings
0013	Usine D'Epuration	-	-	-	-
0028	Barrie WPCP	natural gas	-	2000	digesters buildings
0029	Belleville WPCP	natural gas	1150	20000	digesters buildings
0030	Brantford WPCP	natural gas	5376	1225	digesters buildings
0031	Brockville WPCP	natural gas	23506	3996	digesters buildings
0032	Preston WPCP	fuel oil	1	272	digesters buildings
0033	Galt WPCP	natural gas	2800	578	digesters buildings
0034	Cambellford WPCP	natural gas	-	5000	digesters
0035	Chatham WPCP	natural gas	15544	3200	digesters buildings
0036	Cobourg WPCP #1	natural gas	8530	-	digesters buildings

TABLE B-16. ALTERNATIVE BOILER FUEL CONSUMPTION

NO.	FACILITY NAME	FUELS	CONS. (m^3/y)	COST ($/y)	USE
0037	Collingwood WPCP	oil no. 2	5	975	digesters
0038	Cornwall WPCP	natural gas	-	-	digesters buildings water
0041	North Toronto Plant	fuel oil	10	2350	digesters buildings water
0043	Humber Plant	natural gas	-	1500	digesters buildings
0044	Fergus WPCP	natural gas	-	2500	
0047	Fort Frances WPCP	-	-	-	-
0049	Guelph WPCP	oil	2	424	digesters buildings
0051	Georgetown WPCP	no. 2 fuel	-	-	digesters buildings
0052	Acton WPCP	natural gas	-	-	digesters buildings
0054	Hanover WPCP	natural gas	-	3200	-
0059	Kitchener WPCP	oil	1	46	digesters buildings
0061	Midland WPCP	natural gas	22727	5227	digesters buildings
0062	Milton WPCP	-	-	-	-
0063	Lakeview WPCP	-	-	-	-
0064	Clarkson WPCP	natural gas	-	13000	digesters buildings
0066	Napanee WPCP	natural gas	-	12106	digesters

TABLE B-16. ALTERNATIVE BOILER FUEL CONSUMPTION

NO.	FACILITY NAME	FUELS	CONS. (m^3/y)	COST ($/y)	USE
0067	Watts Creek WPCP	oil no. 2	13	3591	digesters buildings
0068	Port Darlington WPCP	natural gas	-	-	digesters buildings
0070	Stamford WPCP	-	-	-	digesters buildings
0073	South West WPCP	natural gas	-	4367	digesters buildings
0075	Orangeville WPCP	natural gas	57015	-	digesters buildings
0076	Orillia WPCP	natural gas	25608	5725	digesters buildings
0077	Harmony Cr. WPCP	natural gas	-	7000	digesters buildings
0079	Green Creek WPCP	natural gas & fuel oil	45813	9163	digesters buildings
0082	Pembroke WPCP	natural gas	55500	10000	digesters buildings
0083	Point Edward WPCP	-	-	-	-
0084	Port Hope WPCP	no. 2 oil	32	9709	digesters buildings
0085	Edwardsburg WPCP	natural gas	-	-	digesters
0087	Sarnia WPCP	natural gas	19145	-	-
0088	Highland Creek Plant	natural gas	930000	150000	buildings
0089	Simcoe WPCP	natural gas	29494	5100	digesters buildings

TABLE B-16. ALTERNATIVE BOILER FUEL CONSUMPTION

NO.	FACILITY NAME	FUELS	CONS. (m^3/y)	COST ($/y)	USE
0091	Stratford WPCP	natural gas	-	114	digesters buildings
0092	Sturgeon Falls WPCP	natural gas	5870	11289	digesters buildings
0093	Port Dalhousie WPCP	natural gas	105564	18897	digesters buildings
0095	St. Thomas WPCP	-	-	-	-
0097	Thunder Bay WPCP	natural gas	43800	12000	digesters buildings
0098	Mattagami WPCP	natural gas	114419	23307	digesters buildings
0102	Valley East WPCP	oil	-	-	digesters buildings
0103	Walkerton WPCP	natural gas	724	146	digesters buildings
0105	Waterloo WPCP	no. 2 oil	104	24128	digesters buildings
0106	Welland WPCP	natural gas	68747	24128	digesters hot water
0107	Pringle Creek WPCP 1	natural gas	-	-	-
0111	Gimli Ind. Park WTP	-	-	-	-
0113	Northend WPCC	-	1800	30000	digesters buildings
0114	North Battleford WWTP	-	-	-	-
0115	Regina WWTP	natural gas	725586	89000	digesters buildings
0116	H. McIvor Wier WPCP	natural gas	3000	400	digesters buildings

TABLE B-16. ALTERNATIVE BOILER FUEL CONSUMPTION

NO.	FACILITY NAME	FUELS	CONS. (m^3/y)	COST ($/y)	USE
0117	Fish Creek STP	natural gas	-	70000	digesters buildings
0118	Bonnybrook STP	natural gas	-	14795	digesters buildings
0119	Gold Bar WWTP	natural gas	-	12000	digesters buildings
0122	Red Deer WTP	natural gas	-	-	digesters buildings
0125	Nanaimo	oil	2	818	digesters buildings
0126	Nelson City	fuel oil	2	640	digesters buildings
0130	David S. Mackay	natural gas	-	1860	digesters
0131	Skyway WPCP	natural gas	170	2500	digesters buildings
0132	Peterborough WPCP	fuel oil	-	-	digesters buildings

* only those plants with an active anaerobic digestion system have been included.d

TABLE B-17. ENGINE DESCRIPTION *

NO.	FACILITY NAME	SIZE (kW)	TYPE	MANUFACTURER
0003	Wabush WTF	-	-	-
0005	Mill Cove WPCP	-	-	-
0007	Lakeside Timberlea STP	-	-	-
0009	Oromocto	-	-	-
0010	Usine D'Epuration	1000	-	Ruston
0013	Usine D'Epuration	-	-	-
0028	Barrie WPCP	-	-	-
0029	Belleville WPCP	-	-	-
0030	Brantford WPCP	-	-	-
0031	Brockville WPCP	-	-	-
0032	Preston WPCP	-	-	-
0033	Galt WPCP	-	-	-
0034	Cambellford WPCP	-	-	-
0035	Chatham WPCP	-	-	-
0036	Cobourg WPCP #1	-	-	-
0037	Collingwood WPCP	-	-	-
0038	Cornwall WPCP	-	-	-
0041	North Toronto Plant	-	-	-
0043	Humber Plant	-	duel fuel	National Gas, Oil
0044	Fergus WPCP	-	-	-
0047	Fort Frances WPCP	-	-	-
0049	Guelph WPCP	-	-	-
0051	Georgetown WPCP	-	-	-
0052	Acton WPCP	-	-	-
0054	Hanover WPCP	-	-	-
0059	Kitchener WPCP	-	-	-
0061	Midland WPCP	-	-	-
0062	Milton WPCP	-	-	-
0063	Lakeview WPCP	-	-	-
0064	Clarkson WPCP	-	-	-
0066	Napanee WPCP	-	-	-
0067	Watts Creek WPCP	-	-	-
0068	Port Darlington WPCP	-	-	-
0070	Stamford WPCP	-	dual fuel	Caterpillar
0073	South West WPCP	-	-	-
0075	Orangeville WPCP	-	-	-
0076	Orillia WPCP	-	dual fuel	Crothers
0077	Harmony Cr. WPCP	-	-	-
0079	Green Creek WPCP	-	-	-
0082	Pembroke WPCP	-	-	-
0083	Point Edward WPCP	-	-	-
0084	Port Hope WPCP	-	-	-
0085	Edwardsburg WPCP	-	-	-
0087	Sarnia WPCP	-	-	-
0088	Highland Creek	-	Climax V85	-
		-	-	-

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TABLE B-17. ENGINE DESCRIPTION

NO.	FACILITY NAME	SIZE (kW)	TYPE	MANUFACTURER
0089	Simcoe WPCP	-	-	-
0091	Stratford WPCP	-	-	-
0092	Sturgeon Falls WPCP	-	-	-
0093	Port Dalhousie WPCP	-	-	-
0095	St. Thomas WPCP	-	-	-
0097	Thunder Bay WPCP	-	-	-
0098	Mattagami WPCP	-	-	-
0102	Valley East WPCP	-	-	-
0103	Walkerton WPCP	-	-	-
0105	Waterloo WPCP	-	-	-
0106	Welland WPCP	-	-	-
0107	Pringle Creek 1	-	-	-
0111	Gimli Ind. Park WTP	-	-	-
0113	Northend WPCC	-	-	-
0114	North Battleford	-	-	-
0115	Regina WWTP	-	-	-
0116	H. McIvor Wier WPCP	-	-	-
0117	Fish Creek STP	-	-	-
0118	Bonnybrook STP	3120	Superior	Cooper Energy
0119	Gold Bar WWTP	-	-	-
0122	Red Deer WTP	-	-	-
0125	Nanaimo	-	-	-
0126	Nelson City	-	-	-
0130	David S. Mackay	-	-	-
0131	Skyway WPCP	-	-	-
0132	Peterborough WPCP	200	Waucheshaw	Atlas Polar

* only those plants with an active anaerobic digestion system have been included.

TABLE B-18. ALTERNATIVE ENGINE FUEL *

NO.	FAILITY NAME	FUELS	CONS. (m^3/y)	COST ($/y)
0003	Wabush WTF	-	-	-
0005	Mill Cove WPCP	-	-	-
0007	Lakeside Timberlea STP	-	-	-
0009	Oromocto	-	-	-
0010	Usine D'Epuration Regional	fuel no. 2	2	800
0013	Usine D'Epuration	-	-	-
0028	Barrie WPCP	-	-	-
0029	Belleville WPCP	-	-	-
0030	Brantford WPCP	-	-	-
0031	Brockville WPCP	-	-	-
0032	Preston WPCP	-	-	-
0033	Galt WPCP	-	-	-
0034	Cambellford WPCP	-	-	-
0035	Chatham WPCP	-	-	-
0036	Cobourg WPCP #1	-	-	-
0037	Collingwood WPCP	-	-	-
0038	Cornwall WPCP	-	-	-
0041	North Toronto Plant	-	-	-
0043	Humber Plant	natural gas	-	1500
0044	Fergus WPCP	-	-	-
0047	Fort Frances WPCP	-	-	-
0049	Guelph WPCP	-	-	-
0051	Georgetown WPCP	-	-	-
0052	Acton WPCP	-	-	-
0054	Hanover WPCP	-	-	-
0059	Kitchener WPCP	-	-	-
0061	Midland WPCP	-	-	-
0062	Milton WPCP	-	-	-
0063	Lakeview WPCP	-	-	-
0064	Clarkson WPCP	-	-	-
0066	Napanee WPCP	-	-	-
0067	Watts Creek WPCP	-	-	-
0068	Port Darlington WPCP	propane	-	-
0070	Stamford WPCP	-	-	-
0073	South West WPCP	-	-	-
0075	Orangeville WPCP	natural gas	-	-
0076	Orillia WPCP	-	-	-
0077	Harmony Cr. WPCP	-	-	-
0079	Green Creek WPCP	-	-	-
0082	Pembroke WPCP	-	-	-
0083	Point Edward WPCP	-	-	-
0084	Port Hope WPCP	-	-	-
0085	Edwardsburg WPCP	-	-	-
0087	Sarnia WPCP	natural gas	-	-
0088	Highland Creek Plant	-	-	-

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TABLE B-18. ALTERNATIVE ENGINE FUEL

NO.	FACILITY NAME	FUELS	CONS. (m^3/y)	COST ($/y)
0089	Simcoe WPCP	-	-	-
0091	Stratford WPP	-	-	-
0092	Sturgeon Falls WPCP	-	-	-
0093	Port Dalhousie WPCP	-	-	-
0095	St. Thomas WPCP	-	-	-
0097	Thunder Bay WPCP	-	-	-
0098	Mattagami WPCP	-	-	-
0102	Valley East WPCP	-	-	-
0103	Walkerton WPCP	-	-	-
0105	Waterloo WPCP	-	-	-
0106	Welland WPCP	-	-	-
0107	Pringle Creek WPCP No. 1	-	-	-
0111	Gimli Ind. Park WTP	-	-	-
0113	Northend WPCC	-	-	-
0114	North Battleford WWTP	-	-	-
0115	Regina WWTP	-	-	-
0116	H. McIvor Wier WPCP	-	-	-
0117	Fish Creek STP	-	-	-
0118	Bonnybrook STP	-	-	-
0119	Gold Bar WWTP	natural gas	-	-
0122	Red Deer WTP	-	-	-
0125	Regional District of Nanaimo	-	-	-
0126	Nelson City	-	-	-
0130	David S. Mackay Env. Centre	-	-	-
0131	Skyway WPCP	-	-	-
0132	Peterborough WPCP	-	-	-
		none	-	-

* only those plants with an active anaerobic digestion system have been included.

TABLE B-19. ENGINE USE *

NO.	FACILITY NAME	ENGINE USE	GEN. (kW/d)	HEAT REC. (kJ/d)	HEAT REC. SOURCE
0003	Wabush WTF		-	-	
0005	Mill Cove WPCP		-	-	
0007	Lakeside Timberlea		-	-	
0009	Oromocto		-	-	
0010	Usine D'Epuration	electricity heat	1000	2500000	exhaust & engined coolant
0013	Usine D'Epuration				
0028	Barrie WPCP		-	-	
0029	Belleville WPCP		-	-	
0030	Brantford WPCP		-	-	
0031	BrocKville WPCP		-	-	
0032	Preston WPCP		-	-	
0033	Galt WPCP		-	-	
0034	Cambellford WPCP		-	-	
0035	Chatham WPCP		-	-	
0036	Cobourg WPCP #1		-	-	
0037	Collingwood WPCP		-	-	
0038	Cornwall WPCP		-	-	
0041	North Toronto Plant		-	-	
0043	Humber Plant	process air blowers	-	-	waste heat boilers
0044	Fergus WPCP		-	-	
0047	Fort Frances WPCP		-	-	
0049	Guelph WPCP		-	-	
0051	Georgetown WPCP		-	-	
0052	Acton WPCP		-		
0054	Hanover WPCP		-	-	
0059	Kitchener WPCP		-	-	
0061	Midland WPCP		-	-	
0062	Milton WPCP		-	-	
0063	Lakeview WPCP		-	-	
0064	Clarkson WPCP		-	-	
0066	Napanee WPCP		-	-	
0067	Watts Creek WPCP		-	-	
0068	Port Darlington WPCP		-	-	
0070	Stamford WPCP		300	-	
0073	South West WPCP		-	-	
0075	Orangeville WPCP	power outages, load shaving & co-gen	-	-	heat exch. on block & muffler
0076	Orillia WPCP		-	-	
0077	Harmony Cr. WPCP		-	-	
0079	Green Creek WPCP		-	-	

TABLE B-19. ENGINE USE

NO.	FACILITY NAME	ENGINE USE	GEN. (kw/d)	HEAT REC. (kJ/d)	HEAT REC. SOURCE
0082	Pembroke WPCP		-	-	
0083	Point Edward WPCP		-	-	
0084	Port Hope WPCP		-	-	
0085	Edwardsburg WPCP		-	-	
0087	Sarnia WPCP		-	-	
0088	Highland Creek	electric power	-	-	
0089	Simcoe WPCP		-	-	
0091	Stratford WPCP		-	-	
0092	Sturgeon Falls		-	-	
0093	Port Dalhousie		-	-	
0095	St. Thomas WPCP		-	-	
0097	Thunder Bay WPCP		-	-	
0098	Mattagami WPCP		-	-	
0102	Valley East WPCP		-	-	
0103	Walkerton WPCP		-	-	
0105	Waterloo WPCP		-	-	
0106	Welland WPCP		-	-	
0107	Pringle Creek 1		-	-	
0111	Gimli Ind. Park		-	-	
0113	Northend WPCC		-	-	
0114	North Battleford		-	-	
0115	Regina WWTP		-	-	
0116	H. McIvor Wier		-	-	
0117	Fish Creek STP		-	-	
0118	Bonnybrook STP		-	-	
		electricity heat	36000	60000	exhaust & engine coolant
0119	Gold Bar WWTP				
0122	Red Deer WTP		-	-	
0125	Nanaimo		-	-	
0126	Nelson City		-	-	
0130	David S. Mackay		-	-	
0131	Skyway WPCP		-	-	
0132	Peterborough WPCP		-	-	
		electrical power	9000	-	

* only those plants with an active anaerobic digestion system have been included.

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TABLE B-20. TOTAL DIGESTER DIMENSIONS

NO.	NO. DIG. (given) (m^3)	STAGE 1 VOLUME (given) (m^3)	STAGE 2 VOLUME (given) (m^3)	TOTAL VOLUME (calc) (m^3)	TOTAL VOLUME (calc)d (m^3)	SURFACE AREA (m^2)
0003	1	-	-	-	643	444
0005	2	-	-	-	1096	770
0007	1	-	850	850	1063	582
0009	1	1385	-	1385	1231	689
0010	4	7500	7500	15000	14768	6160
0013	1	765	132	897	193	185
0028	4	3159	7395	10554	10574	4726
0029	5	6360	5629	11989	11980	5259
0030	6	5191	7606	12797	10053	5532
0031	2	1157	1157	2314	2328	1270
0032	2	2260	2260	4520	4208	1832
0033	2	3555	2286	5841	5724	2637
0034	1	507	-	507	505	352
0035	2	2490	2490	4980	4678	2176
0036	2	2500	960	3460	3454	1796
0037	4	2450	2185	4635	4404	2532
0038	2	2336	2336	4672	4494	2138
0041	10	-	-	-	13968	6988
0043	6	34450	17225	51675	51798	16758
0044	1	603	-	603	602	405
0047	1	892	-	892	888	525
0049	1	-	2727	2727	2366	1040
0051	2	2492	564	3056	2147	1270
0052	2	615	339	954	938	676
0054	2	1519	1318	2837	3464	1637
0059	4	13452	11328	24780	17514	7186
0061	2	442	430	872	865	640
0062	2	682	273	955	899	642
0063	3	4680	51100	55780	12515	4959
0064	2	4825	4825	9650	9722	3464
0066	1	990	-	990	1400	703
0067	2	1764	1764	3528	3544	1730
0068	2	1402	1422	2824	2666	1427
0070	4	5040	3960	9000	8981	4169
0073	2	2585	2585	5170	6832	2612
0075	2	1798	-	1798	1798	1114
0076	2	1237	1216	2453	2684	1422
0077	2	-	-	-	7384	3080
0079	7	25724	19716	45440	47481	18004
0082	2	877	877	1754	1752	1042
0083	1	544	-	544	548	385
0084	1	1120	-	1120	1120	622
0085	1	491	-	491	494	365
0087	4	-	-	-	-	1578

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TABLE B-20. TOTAL DIGESTER DIMENSIONS

NO.	NO. DIG. (given) (m^3)	STAGE 1 VOLUME (given) (m^3)	STAGE 2 VOLUME (given) (m^3)	TOTAL VOLUME (calc) (m^3)	TOTAL VOLUME (calc) (m^3)	SURFACE AREA (m^2)
0088	2	-	-	-	6586	2798
0089	3	3483	2214	5697	6520	3096
0091	2	-	-	-	10302	3352
0092	1	901	-	901	899	557
0093	3	3682	1578	5260	5257	2727
0095	3	2334	-	2334	-	-
0097	4	4990	4990	9980	12010	4852
0098	2	2273	2273	4546	6278	2500
0102	2	1114	1114	2228	2176	1298
0103	2	1252	1130	2382	2033	1183
0105	4	9088	8879	17967	17036	7218
0106	2	2322	2290	4612	4125	2064
0107	2	1561	1561	3122	4190	1830
0111	1	-	-	-	196	197
0113	6	22200	22200	44400	40170	15366
0114	2	780	780	1560	1566	980
0115	3	6840	3200	10040	11484	4476
0116	2	7433	7433	14866	12852	4606
0117	4	11693	4405	16098	14824	6174
0118	12	90873	-	90873	34780	21908
0119	6	44000	-	44000	70464	18157
0122	4	8000	-	8000	7992	3848
0125	2	2000	2000	4000	3990	1776
0126	2	794	794	158	1588	952
0130	1	1100	-	1100	1106	654
0131	3	8200	16400	24600	24051	8157
0132	3	3180	2270	5450	5621	2658

* only those plants with an active anaerobic digestion system have been included.

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APPENDIX C

STATISTICAL ANALYSIS OF THE BIOGAS DATA

TABLE C-1. STEPWISE LINEAR REGRESSION - DESIGN FLOW

VARIABLE PRODFLOW ENTERED R SQUARE = 0.7961 C(P) = 2.0007

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	2473507098.19	1236753549.09	89.82	0.0001
ERROR	46	633357783.45	13768647.47		
TOTAL	48	3106864881.63			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	378.8123				
DESFLOW	0.0470	0.003593	2352594013.08	170.87	0.0001
PRODFLOW	-0.0143	0.007135	55564770.51	4.04	0.0504

BOUNDS ON CONDITION NUMBER: 1.153477, 4.613909

TABLE C-2. STEPWISE LINEAR REGRESSION - AVERAGE FLOW

VARIABLE PROAFLOW ENTERED R SQUARE = 0.8657 C(P) = 2.4867

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	2689542043.58	1344771021.79	148.23	0.0001
ERROR	46	417322838.05	9072235.61		
TOTAL	48	3106864881.63			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-134.5191				
AVEFLOW	0.0773	0.004598	2565624260.43	282.80	0.0001
PROAFLOW	-0.0322	0.007896	151279432.82	16.67	0.0002

BOUNDS ON CONDITION NUMBER: 1.240298, 4.961192

TABLE C-3. STEPWISE LINEAR REGRESSION - POPULATION

VARIABLE POPFLOW ENTERED R SQUARE = 0.8959 C(P) = 0.5152

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	2037427467.11	2037427467.11	378.86	0.0001
ERROR	44	236622063.69	5377774.17		
TOTAL	45	2274049530.80			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-585.3072				
POP	0.0480	0.002467	2037427467.11	378.86	0.0001

BOUNDS ON CONDITION NUMBER: 1, 1

TABLE C-4. STEPWISE LINEAR REGRESSION - DESIGN BOD

VARIABLE DESBOD ENTERED R SQUARE = 0.5591 C(P) = 2.7383

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	1671640898.17	1671640898.17	50.72	0.0001
ERROR	40	1318310428.81	32957760.72		
TOTAL	41	2989951326.98			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	2215.3505				
DESBOD	0.1246	0.017500	1671640898.17	50.72	0.0001

BOUNDS ON CONDITION NUMBER: 1, 1